California. Dept. of Fish and Game.
Biennial Report 1903-1904.

BIENNIAL REPORT
OF THE
STATE BOARD OF FISH COMMISSIONERS
OF THE
STATE OF CALIFORNIA

1904

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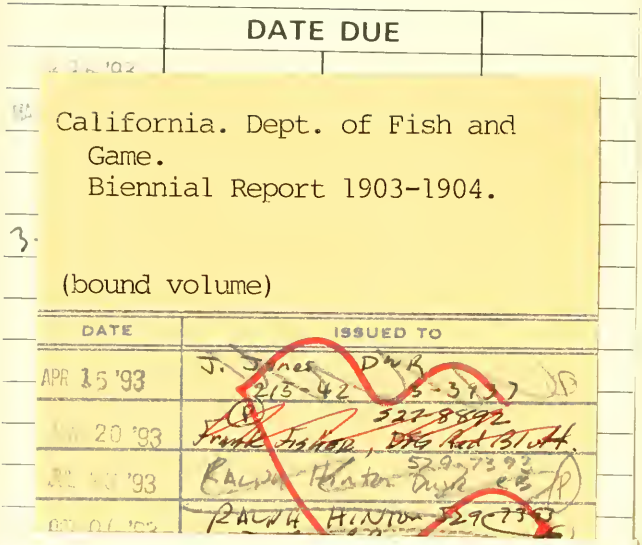
California. Dept. of Fish and Game.
Biennial Report 1903-1904.

(bound volume)



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SISSON HATCHERY, SISSON, CAL.

Showing Mount Shasta in the background. Rainbow Pond in the foreground.

EIGHTEENTH BIENNIAL REPORT

OF THE

State Board of Fish Commissioners

OF THE

STATE OF CALIFORNIA,

FOR THE YEARS 1903-1904.

COMMISSIONERS:

W. W. VAN ARSDALE, *President*, - - - - - - - - - San Francisco.
W. E. GERBER, - - - - - - - - - - - - - - - - Sacramento.

CHAS. A. VOGELSANG, *Chief Deputy*,
Mills Building, San Francisco, Cal.

SACRAMENTO:
W. W. SHANNON, : : : : : SUPERINTENDENT STATE PRINTING.
1904.

EIGHTEENTH BIENNIAL REPORT OF THE STATE BOARD OF FISH COMMISSIONERS.

To Hon. George C. Pardee,

Governor of the State of California:

Sir: In accordance with law, the State Board of Fish Commissioners has the honor to submit for your consideration its Eighteenth Biennial Report, being a record of its work and expenditures from September 1, 1902, to September 1, 1904.

We submit, also, the recommendations which our experience in carrying on this important work has suggested, as tending, in our judgment, to the betterment of both the fish and the game interests.

Since the Seventeenth Biennial Report was submitted, the personnel of this Board has undergone one change. H. W. Keller tendered his resignation on April 24, 1903. On May 6, 1903, W. W. Van Arsdale was elected President of the Board, vice H. W. Keller, resigned.

Regular meetings of the Board have been held during the first of every month, and at such other times as became necessary to the welfare of our work. Complete minutes of all the meetings are on file in our office, rooms 508 and 509, Mills Building, San Francisco. Duplicate bills of every item drawn against the appropriations over which we have control are also on file, and records of the same are on our minute and account books.

On November 29, 1903, the California Fish Commission and all the people interested in the restoration and preservation of the salmon industry of the Pacific Coast sustained an irreparable loss by the death of Mr. Cloudsley Rutter. Mr. Rutter had been stationed on this coast by the United States Fish Commission for a term of years to study out some of the disputed questions regarding the salmon of the Pacific. He was an earnest, intelligent student of all forms of fish life, but his chief work was a study of our salmon, especially the Quinnat, or salmon of the Sacramento River. He had perhaps a more varied and general experience on this subject than any ichthyologist of this country, as he covered not only the scientific but also the practical side of the question. Naturally a man of great ability and force, he devoted all his energy and attainments to the work before him. He was frequently in our service and contributed valuable data and reports that threw light on many conflicting opinions regarding the

movements and habits of salmon. No undertaking was too difficult, no problem too hard to discourage him. He left behind him important notes, which, had he been spared to complete them, would have added much more to his reputation. At the time of his death he was filling the important position of naturalist on the United States Fish Commission's steamer Albatross. From his complete and interesting report, entitled "Natural History of the Quinnat Salmon" (covering a period of five years, 1896 to 1901), which appeared in the bulletin of the United States Fish Commission, 1902, volume XXII, we have taken some important and interesting extracts. A second article from his pen, on the value of artificial propagation, will also be found in the appendix to this report. We commend these papers to the careful attention of all who are interested in the subject of increasing a natural food supply by artificial methods. We regret that space does not permit us to reprint in full his report on "Investigations in the Sacramento River."

The work of patroling the various streams and bays of this State in the enforcement of the fish laws has been intelligently and conscientiously carried on to the full extent of our means. The last session of the Legislature granted an increase in our "fund for the restoration and preservation of game." It was timely, and enabled us to cover more territory in the mountainous districts than has ever before been done. At the same time, our appropriation for this purpose ($7,500 per year) is, in our opinion, ridiculously small when the size of the State and the varieties of game are considered. But few of the counties appoint game wardens. They seem to look to this Board for enforcement of the fish and game laws. It is a notorious fact that constables, who are sworn to enforce the provisions of the Penal Code, are blind to violations of these laws. It is only in rare cases that we find one who is willing to assist in this work. In some counties it has been necessary for the District Attorney to issue special instructions to these officers in regard to their duties in this particular, but the results have not been encouraging. Where an active, intelligent man has been appointed county game warden, we feel that it has been done in response to the pressure of public sentiment. Such officers have created a wholesome respect for the law and for the office, and have assisted us materially. They have made arrests and assisted our deputies in obtaining evidence that secured convictions. The territory covered by our limited force is so vast that we can not afford to keep a man long in one section. The deputies are hurried about from one end of the State to the other.

The fund for the restoration and preservation of game should be increased $5,000, making a total of $12,500 per annum to be expended by this Commission. This would enable us to increase our force of field deputies by four. When it is considered that California is the

second largest State in the Union and that Eastern States not one sixth of its size, with little or no mountainous sections, are using two and three times this amount of money to enforce the laws for the restoration and preservation of game, it will be seen how modest is our request in asking for an increase of $5,000.

Some of our fellow citizens, realizing that violations of the fish and game laws constantly occur, propose to cure the evil by making radical changes. In our opinion this is not the proper remedy. We have sufficient laws on our statute books, but the means to enforce them are inadequate. We will, however, recommend a number of changes that, in our judgment, based upon our experience at court and with "public sentiment," will produce the desired effect; in some cases shortening the seasons, as for example the deer law. Experience has shown that the long open season that was allowed at the last session of the Legislature, with the hope that the Boards of Supervisors would reduce it in their respective counties to two months, has not been carried out, with a result that some counties, with a better appreciation of the value of their deer, have a season of but six weeks, while others allow the full three months and a half. Careful consideration of the subject has brought the conclusion that a State law allowing an open season of two months, and applying to all counties alike, would be the fairest and most equitable settlement of the question.

In our opinion the present duck law should be amended. Our first recommendation would be to reduce the bag limit from fifty to twenty-five. This undoubtedly will be contested by many of the preserve sportsmen, as on their baited ponds and patroled lands the growing scarcity of ducks is hardly, if at all, noticeable. Twenty-five ducks is three times the number that one man and his family could use in a single day, and is practically all that can be carried. One of the arguments advanced to retain the bag limit of fifty is that there are many days on which the sportsman goes to his preserve and does not get his full limit, in fact sometimes gets not more than a dozen birds, but this is probably due to weather or other local conditions. Is it not reasonable to suppose that if the bag limit is reduced one half, there will be a larger number of birds left, which will bring the average day's shoot nearer to the bag limit of twenty-five?

We would also include the dove in the bag-limit reduction; and would recommend that doves, snipe, rail, and other shore birds be added to the non-sale list.

With a few minor changes in the laws relating to the preservation of fish, we believe the best interests of the State will be served.

We believe in following a liberal but progressive policy, from year to year, forging ahead and carrying with us public sentiment, the support of which is absolutely essential to a proper enforcement of these laws.

Public sentiment favorable to game protection is not created by the passage of radical measures. In fact, the converse is true. We believe in educating the public to the importance of these laws, and to the necessity for restrictions; it is therefore our policy to prosecute vigorously when the laws are violated. The Supreme Court of this State has set the seal of approval upon all of the important sections of the Penal Code that refer to fish and game. In our opinion it is wise to hold to that of which we are sure and which our people are learning to respect more and more every year. The fact that our efforts are supported is best shown by the larger number of arrests and by the larger amount paid in fines; the violators have realized that public sentiment is not with them, but in favor of the law. We recognize the existence of slight inequalities, but we believe it to be the part of wisdom to make haste slowly and not to burden the Legislature with frequent and trifling changes. The public, the courts, and the peace officers are becoming more familiar with the present fish and game laws; and with a limited number of changes we believe the majority of our people will be satisfied and their best interests fully served. In brief, we have plenty of laws, but we require a little more financial assistance and certain slight corrections in the Penal Code to attain the desired ends—the restoration and preservation of our fish and game.

TABLE OF ARRESTS AND FINES PAID.

The following statement is a brief record of the two years' work done by our patrol force, upon whom it reflects the greatest credit. The variety of cases indicates that their work has been thorough and far-reaching. In a large number of cases the defendants pleaded guilty, indicating the thoroughness with which the evidence had been collected; and the total amount of fines paid shows that public sentiment is strongly in favor of the enforcement of the laws for the preservation of fish and game.

For the two years ending August 31, 1904, our patrol force has to its credit a record of 550 arrests, against 343 for the two preceding years, showing a gain of 207. There were 225 arrests for violation of the fish laws, against 105 during the two years previous. For violation of the game laws 325 arrests were made, against 238 for the preceding two years. The total amount of fines imposed for violations of both fish and game laws aggregates the substantial sum of $11,738. Of this amount $4,989 was paid by violators of the fish laws, and $6,749 by those who had violated the game laws. The largest amount collected for transgression of any game law was for violation of those provisions of Section 626 which relate to deer, there being 135 arrests, and fines

amounting to $3,035. Next on the list is the record of 109 arrests for violation of the quail law, for which the sum of $2,344 was paid. For transgressing the fish laws, the greatest number of arrests and the largest amount paid in fines were for violation of the laws relating to striped bass, showing a total of 69 arrests and $1,340 paid in fines. The next in importance were the arrests and fines paid for violation of the salmon law, there being 15 arrests and a total of $1,040 paid in fines. This is a less amount than was collected during the two preceding years; but the minimum penalty of $200 for violation of the salmon law (the cases being triable in the Superior Court, where convictions are almost certain) and the rendering of an important decision by our Supreme Court, sustaining the salmon law (*People* vs. *Paul Haagen*, May 20, 1903), had their effect. In other words, fishermen realize that tampering with the salmon law is a dangerous and costly experiment.

While the same number of arrests for violation of the duck law were made in the past two years as in the two preceding ones, it will be noticed that there was $170 less paid in fines. The market dealers and commission houses having organized themselves into transportation companies, which have a legal right to handle more than fifty ducks, it was extremely difficult to obtain evidence to convict; besides, many of them are corporations, and owing to a defect in the Code of Civil Procedure, which renders the prosecution of a corporation for a misdemeanor almost impossible, our efforts in that direction have been seriously handicapped.

In addition to cases which were brought regularly into court, there have been examined hundreds of complaints, some of which were not made in good faith, and others in which sufficient evidence could not be obtained to warrant a prosecution.

Our deputies also made many seizures of fish and game in transit—fish that were under weight or that had been taken in violation of law; prohibited game offered for sale or shipped contrary to law, and because of violation of the bag limit. In many cases convictions followed the seizure. In others we were unable to locate the shippers, who resorted to fictitious names. Their punishment was effected by confiscating the shipments, which meant a loss of time, labor, material, and goods. More than 13,617 pounds of striped bass, 24,000 pounds of salmon, 1,200 pounds of steelhead, 1,290 pounds of sturgeon, 260 dozen abalones, and 600 pounds of trout were seized as evidence against violators of the fish laws.

More than 1,500 California deer hides that were offered for sale, or cached awaiting a favorable opportunity to ship, have been seized by our deputies. Some were in transit as baggage, being packed in trunks; others were in dry-goods boxes, marked "household goods," and con-

signed to private residences. In some cases sufficient evidence was secured to obtain convictions; in others, the shippers had covered their tracks by using fictitious names, but were penalized to the extent of losing their goods. There being no statute providing for the destruction of the hides, they were disposed of to tanneries, and the proceeds deposited in the Game Preservation Fund.

About 111 dozen quail, 175 dozen ducks, 30 dozen doves, and snipe, grouse, pheasants, and venison in small lots were distributed among the hospitals, the orphan asylums, and old people's charity homes of San Francisco. The Little Sisters of the Poor, the Almshouse, the Protestant, Hebrew, and Catholic orphan asylums were among the beneficiaries. From all of these institutions we have received most grateful letters of acknowledgment.

FISH CASES.

Summary of Arrests made by Deputies of the Fish Commission, and Disposition of Cases, for Two Years ending August 31, 1904.

Number of Arrests.	Violation Charged With.	Convicted.	Acquitted.	Dismissed.	John Doe Complaints, Parties Unknown.	Fines.	Number of Days' Imprisonment.
4	Catching or possession of salmon, "closed season"	1		3		$200 00	
4	Taking salmon above tidewater	2		2		40 00	
7	Catching salmon on Saturday or Sunday	4		3		800 00	
5	Spearing steelhead	5				110 00	
8	Steelhead, "closed season"	2	1	5		60 00	
69	Possession or selling underweight striped bass	60	5	4		1,340 00	
4	Black bass, "closed season," and other than with hook and line	1		3		25 00	
15	Trout, "closed season"	12		3		220 00	25
3	Catching trout with net	2		1		80 00	
5	Possession or selling underweight trout	1		1		85 00	
17	Using set-net	7	2	8		400 00	166
6	Sturgeon in possession	4	2			110 00	
1	Catching or possession of "young of fish"	1				25 00	
1	Possession of female crabs	1				25 00	
4	Crabs, illegal size	3		1		60 00	
3	Crabs, "closed season"	3				70 00	
12	Shrimps, "closed season"	8		4		165 00	2
12	Using explosives	4	4	4		500 00	20
3	Dumping slabs or sawdust into waters of State			3			
	Set-nets removed from waters (parties unknown)				47		
2	Small-mesh nets	2				40 00	
17	Abalones, illegal size	14	2	1		325 00	30
9	Crawfish, "closed season"	8		1		120 00	50
8	Crawfish, "illegal size"	6	1	1		140 00	
6	Fishing without license	6				49 00	
225	Totals	160	17	48	47	$4,989 00	293

GAME CASES.

Summary of Arrests made by Deputies of the Fish Commission, and Disposition of Cases, for Two Years ending August 31, 1904.

Number of Arrests.	Violation Charged With.	Convicted.	Acquitted.	Dismissed.	John Doe Complaints. Parties Unknown.	Fines.	Number of Days' Imprisonment.
*4	Doves, "bag limit"	3				$100 00	
*13	Killing or possession of doves, "closed season"	12				320 00	
10	Ducks, "bag limit"	4	1	5		100 00	
17	Killing or possession of ducks, "closed season"	12	2	3		250 00	25
3	Netted ducks (drowned)	1	2			25 00	
15	Quail, "bag limit"	10		5		278 00	
71	Killing or possession of quail, "closed season"	59		12		1,576 00	25
15	Offering quail for sale	10	3	2		240 00	25
4	Trapping quail	4				100 00	
1	Quail in possession without permit	1				25 00	
3	Chinese quail in possession	3				125 00	
2	Deer, "bag limit"	2				50 00	
1	Running deer with dogs	1				25 00	
36	Killing deer, "closed season"	23	10	3		710 00	30
33	Possession of deer meat, "closed season"	30	1	2		845 00	43
*38	Killing female deer or fawn	29	1	7		820 00	40
5	Possession of female deer hides	4	1			100 00	
11	Removing evidence of sex from deer hides	9	1	1		275 00	
6	Sale of deer hides	6				160 00	
*3	Sale of deer meat	2				50 00	
12	Night shooting	6		6		150 00	
2	Trespass	2				25 00	25
1	Snipe, "bag limit"	1				25 00	
5	Plover, "closed season"	3	1	1		75 00	
5	Grouse, "closed season"	4		1		100 00	
3	Shooting meadowlarks	3				45 00	
1	Possession of pheasants	1				50 00	
*5	Tree squirrel, "closed season"	4				105 00	
325	Totals	249	23	48		$6,749 00	213

*5 cases pending.

The following comparative table is interesting, showing the increase in the number of arrests from year to year and the amount of fines paid during the past eight years:

Biennial Period.	Violation of Deer Law.		Violation of Quail Law.		Violation of Duck Law.		Violation of Salmon Law.		Violation of Striped Bass Law.		Set Nets Seized and Condemned.	Total Fines from all Sources.
	No. of Arrests.	Fines Paid.	No. of Arrests.	Fines Paid.	No. of Arrests.	Fines Paid.	No. of Arrests.	Fines Paid.	No. of Arrests.	Fines Paid.		
1897–1898	11	$100	7	$40	14	$220	19	$200	8	$100	30	$3,125
1899–1900	37	735	13	350	6	220	18	900	47	805	23	5,779
1901–1902	75	1,600	97	1,775	30	545	23	2,400	26	185	28	9,497
1903–1904	135	3,035	109	2,344	30	375	15	1,040	69	1,340	47	11,738

SEIZURES OF FISH, GAME, ETC., MADE BY DEPUTIES—1903-1904.

47 set-nets removed from water. Owners unknown. Lines destroyed.
2 sturgeon lines seized. Owners unknown. Lines destroyed.
13,617 pounds underweight striped bass seized. Donated to hospitals and asylums.
24,000 pounds of salmon seized. Donated to hospitals and asylums.
1,200 pounds of steelhead seized. Donated to hospitals and asylums.
1,290 pounds of sturgeon seized. Donated to hospitals and asylums.
600 pounds of trout seized. Donated to hospitals and asylums.
2,000 undersized abalones seized. Dumped overboard.
175 dozen ducks seized. Donated to hospitals and asylums.
111 dozen quail seized. Donated to hospitals and asylums.
32 dozen plover seized. Donated to hospitals and asylums.
30 dozen doves seized. Donated to hospitals and asylums.
6 dozen snipe seized. Donated to hospitals and asylums.
6 dozen grouse seized. Donated to hospitals and asylums.
2 dozen pheasants seized. Donated to hospitals and asylums.
1,500 deer hides seized. Tanned, and converted into coin, which was deposited in the Game Preservation Fund.

FINANCIAL STATEMENT.

The resources and expenditures of this Commission have been as follows for the fifty-fourth and fifty-fifth fiscal years, ending June 30, 1904:

FIFTY-FOURTH FISCAL YEAR.

	Resources.	Disbursements.
Appropriation for support and maintenance of State hatcheries	$10,000 00	$10,000 00
Appropriation for restoration and preservation of fish	7,500 00	7,500 00
Appropriation for restoration and preservation of game	3,750 00	3,750 00
Steelhead Propagation Fund—		
Balance on hand July 1, 1902	1,305 15	
Drawn from fund during year		528 32
Balance on hand June 30, 1903		776 83
Pit River Fishway—		
Appropriation available July 1, 1902	3,000 00	
Amount drawn during year		2,058 50
Balance on hand June 30, 1903		941 50
Game Preservation Fund—		
Balance on hand July 1, 1902	1,090 27	
Receipts during year	3,051 67	
Amount drawn during year		2,343 03
Balance on hand June 30, 1903		1,798 91
Fish Commission Fund—		
Balance on hand July 1, 1902	4,835 28	
Receipts from licenses and fines	6,872 93	
Amount drawn from fund during year		6,799 94
Balance on hand June 30, 1903		4,908 27
Totals	$41,405 30	$41,405 30

FIFTY-FIFTH FISCAL YEAR.

	Resources.	Disbursements.
Appropriation for support and maintenance of State hatcheries	$12,500 00	$12,500 00
Appropriation for restoration and preservation of fish	10,000 00	10,000 00
Appropriation for restoration and preservation of game	7,500 00	7,500 00
Steelhead Propagation Fund—		
Balance on hand July 1, 1903	776 83	
Drawn from fund during year		151 50
Balance on hand June 30, 1904		625 33
Sisson Improvement Fund	10,000 00	
Amount drawn during year		10,000 00
Game Preservation Fund—		
Balance on hand July 1, 1903	1,798 91	
Receipts from fines during year	3,040 22	
Amount drawn during year		2,922 27
Balance on hand June 30, 1904		1,916 86
Fish Commission Fund—		
Balance on hand July 1, 1903	4,908 27	
Receipts from licenses and fines	8,697 82	
Amount drawn from fund during year		6,280 57
Balance on hand June 30, 1904		7,325 52
Totals	$59,222 05	$59,222 05

PAYMENT OF CLAIMS IN FISH CASES.

At the last session of the Legislature, with your indorsement and approval, we presented a bill amending the Act approved February 27, 1887, relating to costs for prosecuting violations of fish laws, and making it mandatory upon all claimants to present their claims to this Board for approval and finally to be paid out of the Fish Commission Fund. In addition, other sections of the Penal Code, namely, Sections 629, 635, and 637, were amended and simplified. Trials for violations were confined to the Superior Court, the expense to be borne by the State instead of by the county, and the amount of the fines imposed to be paid into the State Treasury. We are pleased to report that the workings of this law have come up to our fullest expectations. It has brought justices of the peace and constables throughout the State in closer relationship with this office. They look to us for their fees (when under the fee system), and their claims are promptly met. Occasionally we are obliged to return claims for correction, and thereby have saved the State a considerable sum. Formerly these claims were paid out of a special fund appropriated at each session of the Legislature to meet the costs arising from prosecutions for violation of the fish laws. The State Board of Examiners had no means of knowing what services were rendered, and were simply paying claims in the dark. We are in a better position to audit such claims fairly. We feel this has been done. The expense of Superior Court trials has been met by us, and the District Attorneys have scrutinized their bills closely and sent them to us in detail, showing an itemized list of the expenses incurred.

The passage of this Act has made it unnecessary for the Legislature to make any special appropriation for this work. Therefore, we have effected a saving to the State of at least $2,000 per annum, besides which the claimant receives the full amount of his claim, free from cost or unnecessary delay.

SISSON HATCHERY.

It is with much satisfaction that we refer to the splendid record made at our most important station during the past two years. The Legislature of 1903 unanimously granted our request for an appropriation of $10,000, the reasons for which were fully set forth in our last biennial report. In this case, as in all others which related to additional funds with which to further the interests of our work, we had your cordial and hearty support, and your approval of the bills after they had passed through both branches of the Legislature. During the fifty-fourth fiscal year we began to feel more than ever the scarcity of funds. The scope of our work had greatly broadened and demands were made upon this hatchery by sections of the State that had never before presented applications for fish. We have ever been proud of our work at Sisson, but we had also taxed this station to its maximum capacity, and had not the means with which to make the simplest improvements or even ordinary repairs. We had there a most excellent force of trained hatchery employés, whose experience and knowledge of fish culture have induced other Commissions to seek their services. We were not able to make them comfortable on the grounds, nor to compensate them fairly for the efficient services they were rendering. These unfavorable conditions were relieved by this appropriation, and our capacity for efficient service to the State has been greatly enhanced.

The purchase of land necessary for additional ponds, nurseries, and buildings to meet the increased work of the station was made as soon as the money became available, on July 1, 1903. We were able to secure twelve and one third acres of land bounding our property on the north and west. Eleven and one half acres (more or less) on the west, together with a most valuable right to 80 inches of water, were purchased of F. J. Watson for the sum of $800. This land lies on a gentle slope toward Spring Creek, which is its western boundary. It consists of loam resting on a stratum of gravel, and could not be better adapted to the uses of the hatchery. As the work of the Commission increases and broadens, this land can all be laid out into additional ponds and nurseries, which will insure an unfailing supply of eggs. Our work will not then be interrupted as heretofore by storms and washouts in the rivers, to which in the past we have been forced to resort for the capture of wild parent fish. We can then rest secure in the fact that the ponds, with efficient care, will furnish a regular and sufficient supply of eggs. After the purchase of this land, buildings, ponds, and drains were built

thereon to relieve the overcrowded condition inside our original boundaries.

In addition to the above described land, three quarters of an acre was purchased of the Sisson estate, adjoining the hatchery land on the north, for the purpose of erecting thereon a superintendent's dwelling.

We immediately began the very much needed repairs and improvements that had been neglected for four years or more. We increased our number of rearing ponds from ten to nineteen, and built three spawning ponds. We were able to do away with the obsolete wooden flumes, substituting therefor iron pipe-lines; these were placed underground, where they are free from the constant danger that threatened the leaky and uncertain flume system, which was liable to break down under the snows of winter and had already become unsafe from age and decay. The water supply, our greatest necessity, was at all times menaced by interruption. Such an accident would have cost us thousands and perhaps millions of fish and fry. It is a great satisfaction and relief to know that this danger is entirely eliminated, and that our jugular vein is safe. We were also able to replace our old settling tank with a new one, cement lined, 10 by 32 feet, and protected on the outside by corrugated iron, changing its general appearance so that it is one of the attractive features of our grounds. The old sand-box was discarded entirely and a new and improved one was built at the end of our ditch line, 100 yards from the hatchery, where it can be relieved at any time without danger and without shutting off our main supply of water. The new pipe-line supplies the main hatchery building, the auxiliary hatchery (newly built and referred to in Superintendent Shebley's report), and practically all of the ponds now in use. The newly purchased land is located directly under the range of our present water flow and every part of it can be easily reached by piping.

We purchased a good and substantial buckboard, which not only has proved a great saving, but affords many advantages for quick transportation of our supplies that we had not enjoyed in the past.

We built a substantial barn, 20 by 40 feet, ample for the needs of the station for years to come, and covered it with a corrugated iron roof. The meat house, where the fish food is prepared, was practically rebuilt. A new furnace with brick chimney, for cooking the mush and preparing the flesh food used to feed the pond fishes, has been installed. The engine-room was given new floors and foundation. Our ten nursery or rearing ponds have been given planked bottoms, so that the fish can be handled without danger of injury; the fish are also less liable to disease from foul bottoms.

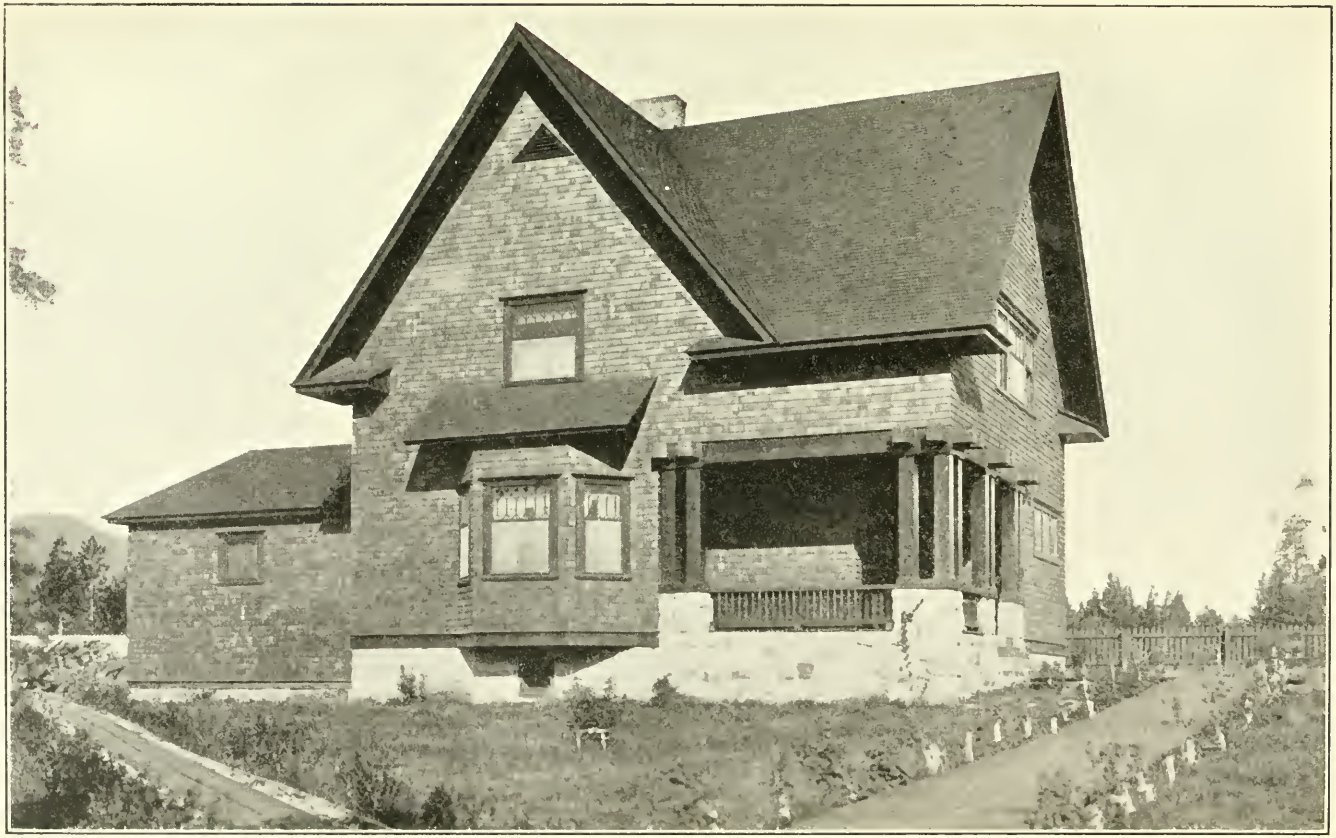
Many needed improvements have been made on our main hatchery building, which is 120 feet in length by 40 feet in width. It had not been painted for four years, and at that time there was used a cheap grade of paint that soon wore off. We gave the entire building two

coats of white lead and oil. The shingled roof, which had done duty since the building was erected fifteen years ago, was rotten and leaky. It was torn off and a corrugated iron roof put on. This roof was given a substantial coat of metallic paint, and the exterior of the building now presents a very attractive appearance. The building, owing to the great weight of the tanks and troughs, had settled, so that it was with difficulty that the hatching boxes in the west end of it could be operated. The building was raised, leveled, and a new foundation put under it, which will last for years. A new distributing tank was constructed the full length of the building, 120 feet. New and improved troughs were added to the front half and all the dangerous ones taken out. We have now eighty-four hatching troughs in the interior of the building. All of them were coated with pure asphaltum, a substance impervious to water, guaranteeing absolute cleanliness and protection against spores and wood rot. We also took out the old wooden drains and substituted new and improved ones.

We felt it to be good judgment to further protect the west part of our enlarged holdings, and have erected, beyond the present line of ponds, a small but comfortable three-room cottage for one of the regular assistants, who occupies it with his family. It is known as the watchman's cottage. It is almost impossible for any one to enter the hatchery grounds from the west side without passing in view of this house. The presence of this habitation serves to keep at a respectful distance kingfishers and other birds of prey that have fattened on our ponds for years. Our watchman has killed a sufficient number of predatory animals and birds that have been making regular inroads on our supply of breeding fish, to justify the expense of putting up this building.

We are now in a position to double our output within the next three years. We have all the land the State will ever require for hatchery purposes in that portion of the State, and have an abundant and never-failing supply of the purest water, sufficient for the continued development of the station for all time.

All the newly acquired land has been enclosed; the lower half of the land bordering on Spring Creek with a barbed wire fence about 1,200 feet long. That portion adjoining the original hatchery land is enclosed with a fence six boards high, which are fastened to extra large cedar posts that will last for many years. On top of the posts on the outside have been fastened arms of wood two by four inches in size and thirty inches long. To these arms are attached three barbed wires, the purpose of which is to prevent trespassers from climbing the fences and getting into the grounds other than through the main gates, which are open to the public every day from 10 A. M. to 4 P. M. The land purchased from the Sisson estate as a site for the superintendent's dwelling has also been enclosed by a substantial and neat picket fence.



SUPERINTENDENT'S DWELLING—SISSON HATCHERY.

We next undertook the construction of a superintendent's dwelling, paying special attention to the conditions that are to be met in a mountainous district where the snowfall ranges from four to ten feet. A two-story eight-room cottage was planned and carried to a successful finish by our Chief Deputy, Charles A. Vogelsang. It was decided to cover the outside of this building with shingles, for two important reasons. The first was that it would render the house, which was ship-lapped on the inside and outside of the studding, as snug and comfortable as any hard-finished interior. The other was that the shingles would require no paint. This is a great saving of expense, for it is well known that to preserve the exterior of any house in good condition, especially in high altitudes, where the climate is subject to extreme changes, it would need repainting every two years. We used red cedar shingles. These were given two coats of oil—one of raw and the other of boiled linseed oil. The roof was given two coats of Cabot's shingle stain—moss green in color and a noted wood preservative. On all the window casings and other outside finished work an oil stain was used, consequently this building has no paint whatever and none will ever be required. We expect the house to present the same handsome appearance ten years hence that it does to-day.

The house rests on a stone foundation. The material used is a handsome mottled gray lava rock, which was found nearby. The same material was used in the construction of the chimney and fireplace in the living room. While the foundation work was going on, a commodious cellar was dug, and this was cement lined. The necessary drains and sewers were also provided for, and connections were made to them as the plumbing progressed during the construction of the house. Careful attention was paid to these details, both as to materials used and as to workmanship.

On the first floor, besides the entrance hall, there are four rooms—a living room, kitchen, dining room, and library. In the large living room an artistic fireplace was built of rough lava stone. This work was done by Mr. Sawyer, of Sisson, a noted chimney and fireplace builder. It has been a success from the start. The entire first floor is finished in attractive, plain and figured burlap. The second floor contains four bed chambers, with spacious closets and a handsome and complete bathroom, fully equipped. Above the bathroom, under the roof, was installed a hundred-gallon water tank, which is kept constantly supplied by a No. 5 Rumsey hydraulic ram. The dwelling was also equipped throughout with electric light wires and fixtures, in view of the fact that we hope to utilize our own water-power to operate a dynamo, which will furnish light to the superintendent's dwelling and all other buildings on the premises, principally the main hatchery building, where, during the winter months, candles or oil lamps are burned for three or four

SISSON HATCHERY.
Partial view of rearing ponds. Watchman's cottage in the rear.

hours each day, and also at night, while salmon eggs are being hatched. A woodshed was also added to the rear of the building and constructed on the same lines and with the same finish as the cottage itself.

In every respect the building is first class. It is cozy, comfortable, attractive, and most substantial. Its presence adds greatly to the appearance of our grounds, but its chief value lies in the fact that it is occupied by the superintendent of the station, W. H. Shebley, whose watchful eye keeps the grounds constantly under surveillance. For many years there was not a soul on the grounds at night. They were practically open to poachers and other trespassers. Serious losses occurred in our ponds. Now this trouble is passed, in addition to which we have a building that is a credit not only to the station, but to the State. It was built, exclusive of the rock work and bathroom equipment, under contract by J. E. Lamborn for the sum of $2,500; the total cost to the State was less than $3,000. It would not have been possible to build such an attractive and thoroughly substantial house for this sum but for the fact that all of the larger establishments to which we applied for material made substantial concessions.

We hold in this office receipted vouchers showing in detail every cent that was expended for labor, material, purchase of lands, and other necessary incidentals for which this appropriation of $10,000 was granted, and we respectfully submit that a more substantial or better showing has never been made by any State institution, and we desire to thank you, and every member of the Legislature, for assistance at a time when it was much needed.

Two years ago, at the time our last biennial report was prepared, we had but 36,000 fish in our ponds, having just begun the rearing of a new stock of breeders. Two years is but a short time in which to accomplish much toward increasing a stock of brood fish, but we are pleased to submit the following figures. We have increased the stock from 36,000 to 108,400 fish and fry, that are fast developing into stock fish. The following is a list of the fish in the ponds:

Adult Rainbow trout (*Salmo irideus*)	1,000
Thirty months' old Rainbow trout (*Salmo irideus*)	10,000
Eighteen months' old Rainbow trout (*Salmo irideus*)	15,000
Six months' old Rainbow trout (*Salmo irideus*)	10,000
Eighteen months' old Steelhead trout (*Salmo gairdneri*)	2,000
Adult Eastern brook-trout (*Salmo fontinalis*)	1,000
Twenty months' old Eastern brook-trout (*Salmo fontinalis*)	25,000
Six months' old Eastern brook-trout (*Salmo fontinalis*)	20,000
Adult Loch Leven trout (*Salmo trutta lernensis*)	400
Adult sunfish (*Lepomis cyanellus*)	2,000
Adult shiners	2,000
Grayling fry (*Thymallus montanus*)	7,000
Loch Leven fry (*Salmo trutta lernensis*)	10,000
Landlocked salmon fry (*Salmo salar sebago*)	3,000
Total	108,400

The output of this station during the past two years, its present prosperous condition, and its prospects for the future, are best shown by the following report, made by W. H. Shebley, the Superintendent of Sisson Hatchery, and we commend its careful perusal by those of our citizens who are interested in this most important subject of fish culture. While some of his statements may seem extraordinary, we assure you that they are made by a conservative man, who is master of his profession.

SISSON, CAL., September 1, 1904.

To the Honorable Board of Fish Commissioners of the State of California:

GENTLEMEN: I herewith submit a report of the operations of the Sisson hatchery for the years 1903 and 1904; also a report on the salmon ova received at this station from the United States Bureau of Fisheries stations in California, from the summer and fall runs of salmon of 1903, and the distribution of the fry. This was the largest hatch of salmon eggs ever made. It is the best record of any station on the Pacific Coast, and of a commercial value second to none in the United States.

This fine record could not have been made, as we would have been unable to take advantage of the opportunities, were it not for the special appropriation made by the last Legislature, which gave us the means to make the many improvements necessary to put the station in order to do first-class work and to improve the pond system to such an extent that we were able not only to hatch these eggs, but to dispose of the fry under conditions that I believe will produce the very highest results. Without this additional money our work would have been seriously handicapped, and young salmon representing hundreds of thousands of fish that are now swimming in our streams and coast waters would never have been hatched.

In addition to handling an extraordinary number of salmon eggs, our trout work went steadily on and we shipped a larger number of trout fry from this station than had been done for years.

Early in the fall of 1903, when it appeared from the large run of salmon in the Sacramento River that the fall run would be larger than the summer run, I planned an auxiliary hatchery, to be built on the canal leading from the hatchery water system to Cold Creek. This canal was dug through the property of the Sisson estate, under an agreement or lease for a term of years to allow us to run the young salmon through it when they were large enough to plant. By distributing the young salmon in this way, a great expense has been saved, and the fry are in better condition to descend the stream to the river than when they are hauled out in wagons. This building is 35 by 40 feet and has a capacity of about 8,000,000 salmon eggs. It proved to be of the greatest value to us during the hatching of this enormous take of salmon ova.

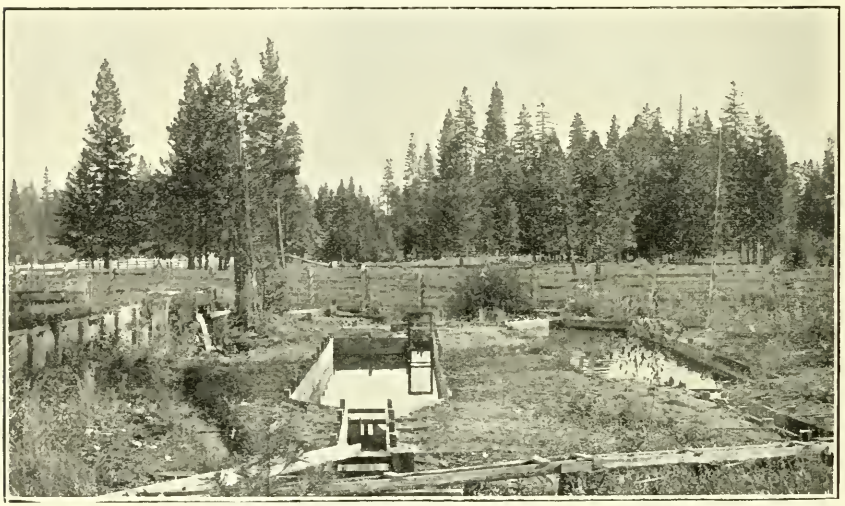
This hatchery receives its water supply from a 6-inch iron pipe-line, put in this summer, connecting the division tank with the new hatchery and a branch line built to give the nurseries and a couple of rearing ponds an independent supply of water, so that the fry can be kept free from zymotic diseases that are apt to attack them if the water becomes foul.

Eight new ponds and a nursery were built—five rearing ponds and three spawning ponds. The rearing ponds were made by dividing the larger ones into smaller compartments. These were made by constructing walls of 2-inch red fir plank firmly spiked to 4 by 6 inch posts driven deep into the earth, and placed 4 feet apart. These walls were then braced by putting 2 by 6 inch scantlings diagonally across the walls from top to bottom. A track was laid on top of the wall and from there to a pit 600 feet distant. A car, with a cable attached to a steam engine, was used to haul the earth from the pit to the walls. This arrangement worked very satisfactorily. Four hundred and sixty feet of embankment or walls were made, averaging 4 feet high, and 4 feet wide between the planks. These ponds are now filled with different ages and sizes of fish that are being raised for breeders.

The spawning ponds were constructed entirely of plank. They were built to place

the fish entirely under control, so that they can be handled during the breeding season without injury and loss. By the old method of handling the spawners a serious loss occurred each season. The fish in their efforts to spawn become emaciated, and if allowed to remain on gravelly or sandy bottoms, get wounded in their work of nest building and efforts at procreation, and a large number die from diseases produced at this time. But if they are removed from the rearing ponds before maturity and placed in the spawning ponds, they can then be handled by those skilled in the work with only a small loss. The loss does not average more than six or eight per cent, if they are carefully handled.

These spawning ponds are made of smoothly planed planks placed on the sides and bottoms of excavations made for the purpose. They are 64 by 15 feet and from 3 to 3½ feet deep. The bottom is built on a gradual elevation, so as to be easily cleaned. There is a spawning race or raceway that connects with the pond and forms the inlet for the water. This has an obstruction or dam in it, where it joins on to the pond, raised to an elevation of from 4 to 10 inches, depending on the variety and size of the trout. The fish when ready to spawn jump over the dam and enter the raceway, where they are caught up and stripped of their eggs. They are then placed in a

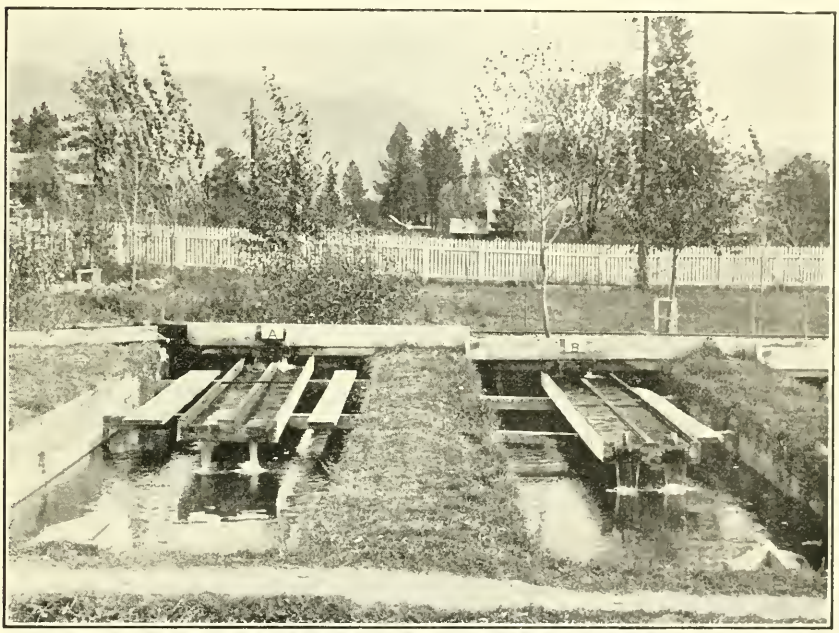


SPAWNING PONDS—SISSON HATCHERY.

smooth-plank-lined pond to recuperate. They are left there until such time when their desire to spawn leaves them and they have begun to feed again. They are then returned to the large rearing ponds. This system of handling spawning fish was improved and made practical by George N. Seagle, Superintendent of Wytheville Station, Virginia, United States Bureau of Fisheries. We are under obligations to him for the plans and information that he kindly sent us. We have made some changes from his plan in constructing the ponds, that I believe are improvements over his. But in each section of the country different conditions arise that must be met by those in charge of the work. There can be no universal rule for the whole country. Mr. Seagle has perfected the system to his use and for the conditions as he finds them.

The salmon eggs from the United States Bureau of Fisheries stations in California were received in good condition, considering the crowded condition of the buildings and the extra work necessary to prepare them for shipment. Superintendent Lambson, in charge of the United States Bureau of Fisheries stations, deserves great credit for the successful manner in which this great run of salmon was handled. Early in the summer of 1903 an unusually large run of salmon were found ascending the Sacramento River on their way to the spawning grounds. Superintendent Lambson accordingly made

arrangements to handle this increased run of fish, and notified us early in the season that he would in all probability take about 30,000,000 eggs from the summer run at Baird station on the McCloud River. Our hatchery at this time was undergoing much needed repairs, which the special appropriation of the Legislature allowed us to make. The work on the troughs was rushed so as to have them in readiness for the eggs. The capacity of Sisson hatchery at this time was 16,000,000 eggs during the hatching period and 8,000,000 embryos during the period of the absorption of the yolk sac. As the desire of the Board was to hatch all the salmon eggs furnished by the United States Bureau of Fisheries stations, I planned a system of troughs to be built over the ten nurseries or rearing ponds, into which the embryo salmon could be put as fast as they hatched. These troughs were made on the same plan as the regular hatching troughs. Two of them were placed side by side on supports over the nurseries, about ten inches from the surface of the water. They extended half way the length of the nursery. The water



SISSON HATCHERY.
Sectional view of nursery ponds, showing arrangement of hatching troughs.

for the nursery was run through the troughs and discharged from the end of the trough into the center of the nursery. The embryos were kept in these troughs until they had partially absorbed the sac and the pigment had taken the place of the mucus in the epidermis. They were then placed in the nursery underneath the troughs. The danger of smothering is passed when they arrive at this stage. This is one of the hardest things to overcome in rearing the embryos in large numbers outside of the regular hatching troughs. This method of handling them proved to be a great success. The embryos were released from the troughs into the nurseries at the proper age, and the troughs refilled from the hatchery with another lot that had just hatched. After the embryos had attained the swimming stage, they were allowed to escape from the nurseries into the canal or ditch connecting the hatchery water system with Cold Creek and from there pass into the main Sacramento River. The loss in rearing with this system was very small after the embryos were turned from the troughs into the nursery. The bottoms of the nurseries are built on an elevation, thus making them easy to clean.

The expectations of Superintendent Lambson at Baird Station were realized, and from August 19th to October 17th, 27,200,000 eggs were shipped from Baird station to Sisson hatchery. These were hatched and the fry released on the dates given in the list of shipments annexed to this report. The second or fall run of salmon proved to be larger than the summer run, and 31,432,000 eggs were secured at Battle Creek and Mill Creek stations, making a total of 58,632,000 eggs for the season—the largest number of salmon eggs ever hatched at one station in one season.

The fry were released during the fall, winter, and spring, in such numbers and at such times as would give them the best chances of descending the river without being crowded or in numbers greater than the food supply. The young salmon were allowed to escape from the nurseries and rearing troughs as soon as the yolk sac had entirely disappeared and they were able to swim without stopping on the bottom to rest, or when their swimming powers were fully developed. They passed down the canal to Cold Creek and from there to the Sacramento River.

This is a most favorable place to release young salmon in large numbers, as there is an abundance of natural food, and the swiftly moving water soon scatters them over a large natural nursery ground. The stream (Cold Creek) and the river fall about 37 feet to the mile, for about 80 miles. This assists the schools of young salmon in passing down the river rapidly. They generally move in schools. The food of young salmon at all times in the streams is insects, both land and aquatic varieties. Examinations made of the fry as the schools were descending the river, always found them well fed and in good condition. The fry descend the river from the hatchery to near Redding at the rate of from 10 to 15 miles a day. Near Redding the river becomes less rapid and their movements are slower. Thus it will be seen that they are soon scattered over a large amount of natural feeding ground. They are from six weeks to four months reaching salt water.

The winter and spring of 1903–04 were very favorable for the movements of young salmon. The great amount of flood water in our rivers and streams kept them constantly on the move, and a smaller per cent than usual of the spring fry remained in the pools at the headwaters of the river during the summer. This means a rapid growth for the majority of the fry. Those that linger in the pools do not thrive, but on the contrary are pigmies and in my opinion produce the majority of the grilse found in the fall ascending the river with the full-grown salmon. The high water in the Sacramento River caused a number of breaks in the levees on the lower river, and probably some of the young salmon were carried into the tule basins and there perished when the water receded. Of this I have no knowledge, but it appears to be a natural conclusion that a certain percentage of them would be carried with the current through the breaks in the levees.

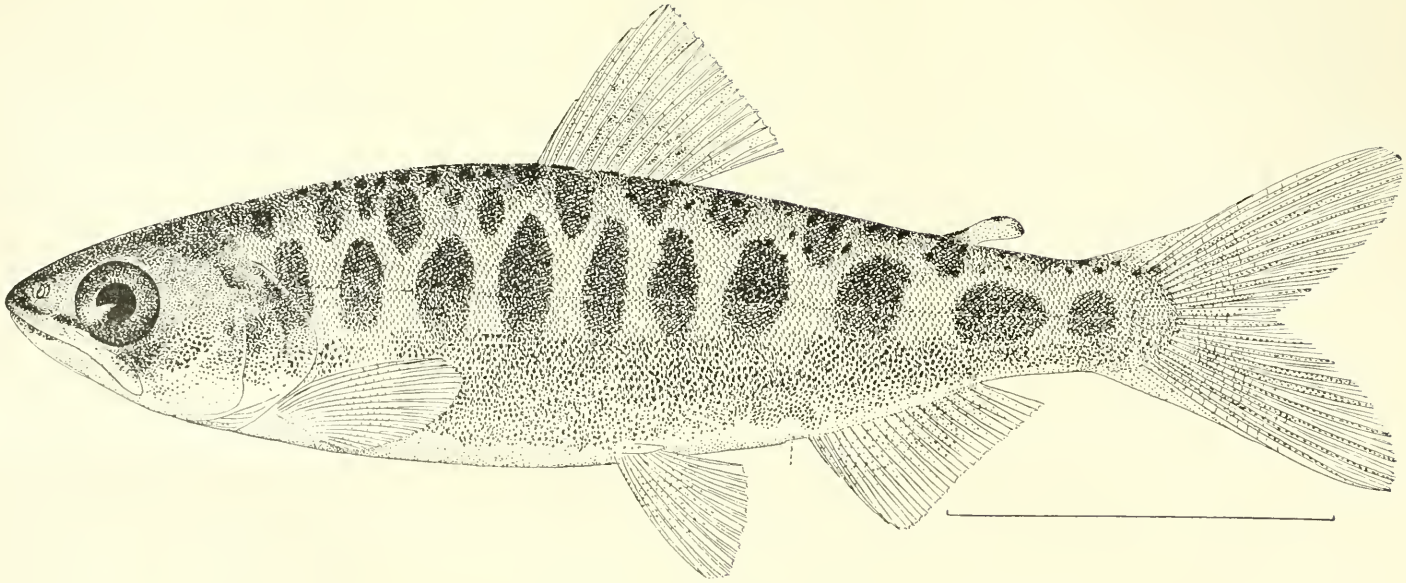
The output of fish from the Sisson hatchery for the two years beginning September 1, 1902, and ending August 31, 1904, is as follows:

Season 1903.

Salmon eggs received from Baird, Battle Creek, and Mill Creek Stations, U. S. Bureau of Fisheries, during summer and fall run of 1902, and hatched and distributed from the Sisson hatchery	14,782,540
Eastern brook-trout fry	415,000
Rainbow trout fry	502,000
Cutthroat trout (*Salmo henshawi*)	752,000
Sunfish	1,356
	16,452,896

Season 1904.

Salmon eggs	58,432,000
Rainbow trout fry	500,000
Eastern brook-trout fry	682,000
Cutthroat trout (*Salmo henshawi*) trout fry	90,000
Loch Leven trout fry	29,000
Landlocked salmon fry	7,000
	59,740,000
Making a grand total of	76,192,896



SALMON FRY. (Four times natural size.)

The last two years have been busy ones at this station, especially the year just closed, when there was expended on these grounds the $10,000 appropriated at the last session of the Legislature. All of the work and improvements were absolutely necessary. The help came when it was most needed. In efficiency and capacity we have gained at least six years. All of the improvements are of a durable and permanent character. We now have eighteen trout-rearing ponds and eleven nurseries. While they require considerable labor to keep them clean and in such order that the fish will thrive, they have been provided with drains so that one pond can be emptied at a time, affording better opportunities for sorting the fry, which important work must be done systematically and by skilled hands, in order that no injury will be done the fish. I find that after the first six months the young fish should be sorted every sixty days, owing to unequal development. The smaller and weaker ones always fall victims to the more precocious and larger ones of their own kind.

The amount of food required for our pond fish will be considerably increased during the coming season. We now use on an average of 240 pounds of prepared food per day.

With its present equipment, this station, in my judgment, will compare favorably with the best in the United States. With an attractive and comfortable home on the grounds and the constant danger that threatened our water supply removed, there is a sense of security and comfort that was never experienced before by myself or other employés of this station.

We will probably secure this fall and winter 300,000 Eastern brook-trout eggs, 200,000 Loch Leven trout eggs, and if our thirty months' old Rainbow trout come up to expectations, 600,000 to 750,000 Rainbow trout eggs. In forecasting the take of eggs, it is difficult to make a close estimate on young fish. As a rule, only thirty per cent of the females come to maturity between thirty months and three years old. I am expecting fully that many to come to maturity this season. After this season, if no epidemic breaks out among the fish or unless some accident happens, the adult spawners will increase very fast. Next season the output should reach 1,000,000 Rainbow and from 1,000,000 to 1,500,000 Eastern brook-trout eggs. The increase from that time on will be rapid.

We have devoted considerable time and labor to beautifying the grounds, putting out shade and ornamental trees, which not only render them more attractive to our summer visitors, but furnish shade and protection to the fish in the ponds, besides supplying them with a certain amount of food in the shape of insect life.

I have been ably assisted in the management of the station by the advice, good judgment, and untiring zeal of your Chief Deputy, Charles A. Vogelsang.

Respectfully submitted.

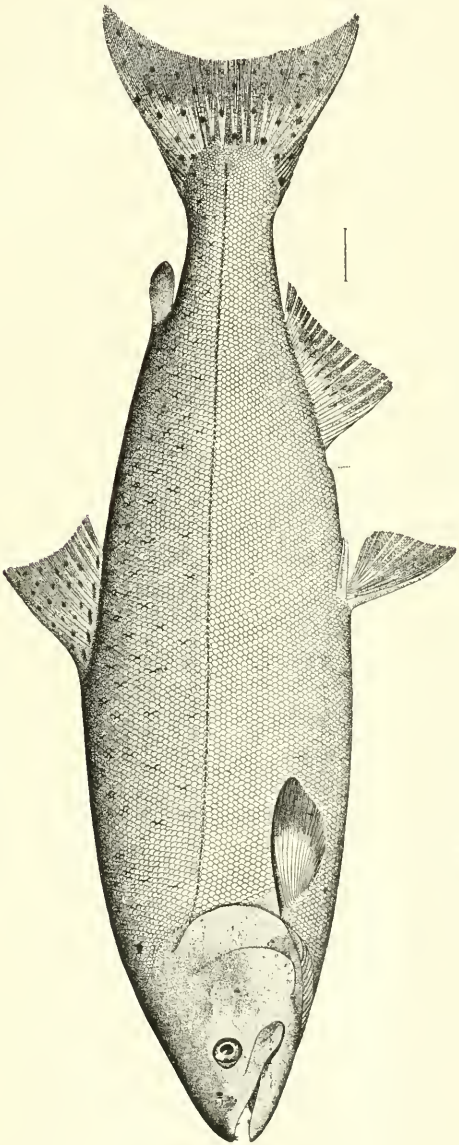
W. H. SHEBLEY,
Superintendent of Sisson Hatchery.

THE SALMON LAW.

We are pleased to report that the existing and most excellent law for the protection and preservation of salmon, which is our most valuable food fish, is being more generally understood and recognized throughout the State. We treated this subject at considerable length in our last biennial report. There have since been very few, if any, criticisms. In fact, the absolute necessity for the seeming but unreal discriminations, as well as the benefits that are so manifestly following the present law, are now so well understood by all intelligent people, that in the upper Sacramento Valley, where most of the former dissatisfaction existed, there has been little or no complaint. The credit for this change in public sentiment is due largely to the broad and enlightened treatment of the question by the press. The people have been kept

advised as to the open and close seasons, and editorial space has been freely given to the subject.

Occasionally we are asked to recommend a change in the date for



SACRAMENTO RIVER, OR QUINNAT, SALMON—*Onchorhynchus chouicha.*

the beginning of the close season, by making it ten days or two weeks later, because it sometimes happens that the fall run is later than usual and the fishermen and dealers are obliged to discontinue their

operations at the height of the run. These requests come mainly from cold-storage people of other States (who operate here) and a few fish dealers whose interests are purely selfish. The principal canneries (those that have been established in our State for years and whose managers have studied the movements of our salmon and have learned the value of artificial propagation) desire no change, unless it be to extend the close season from October 16th to October 25th. The intelligent salmon fisherman is also satisfied.

Under the operations of this law, our salmon supply has continued to show a remarkable increase. These results are not so apparent from the returns by the canneries. The reason is not difficult to find, for the canneries can only afford to pay such a price for fish as will permit them to meet the competition of northern canneries, otherwise there is no profit in the business. In other words, they take only the surplus fish during the heavy runs, when the market is glutted, for which they pay from two to three cents per pound. There is such an increasing demand for our *fresh* salmon and the fishermen receive so much better prices from the cold-storage plants, who prepare them for shipment to Eastern States and States north of us, that the canneries are obliged to depend upon what they can get at their own figure, which is about one half what is paid by the cold-storage plants. In other words, cold-storage plants are taking the place of the canneries. Business concerns from Washington and Oregon have established plants at different points along the Sacramento River from Chico to Vallejo. The fish are also handled by the same process at Monterey.

The common remark that the pioneer saw the palmy days of the salmon run, is not made by men who have lived along the Sacramento River for forty years, who state that never to their knowledge were these fish so numerous as in 1903 and 1904. This statement may seem startling, but our experience and observations will support it. Not only is the Sacramento River and its tributaries producing more salmon than ever before, but the San Joaquin River and its tributaries, the Stanislaus, Tuolumne, and Merced, all show increased runs. Streams in which salmon had not been seen for many years contain them in large numbers now, indicating that the salmon are so plentiful that they spread into all of the smaller streams to find spawning grounds.

The United States Bureau of Fisheries station at Mill Creek, first put in operation three years ago, shows a splendid gain from year to year in its take of salmon eggs. Battle Creek and Baird stations have broken the world's record in the past two years. In the fall of 1903 this Commission handled more than 63,000,000 salmon eggs furnished by these stations. In the fall of 1902 the returns were not so large, owing to early November rains, which swept out the retaining racks and liberated thousands of spawn-bearing fish. At Battle Creek station

it was estimated that there were enough fish between the racks to have furnished 30,000,000 eggs, all of which were lost so far as hatchery work was concerned, allowing the fish to pass up stream and propagate naturally; and when it is remembered that by artificial hatching approximately eighty-seven per cent of these eggs would have been liberated as salmon fry, while under natural conditions not more than one per cent would have survived, the value of artificial propagation is better appreciated.

During the months of April, May, and June, the fishermen on the Sacramento River received as high as 7 cents per pound for their catch. Small stations, like Tehama, ship as much as three tons of fresh salmon in a single day. During the present spring run there was shipped from Chico alone, upward of 80 tons of fresh salmon, which figures were furnished by Wells, Fargo & Co.'s office at that city. Another striking example is afforded by the fact that during the spring and summer of 1903, fresh salmon by the carload were shipped from Sacramento City direct to New York City, also to Boston, Chicago, and other Eastern cities, where the Sacramento River salmon has established a market value of its own, selling for from 30 to 40 cents per pound. Tons of salmon are shipped from San Francisco and points along the Sacramento River to Oregon and Washington, both great salmon-producing States. In the fall of 1903, one steamer carried 45 tons of *fresh* salmon from San Francisco to Astoria.

These facts are laid before our people so that they may better appreciate the great advantages this State enjoys under the existence of the present salmon law, which has stood the constitutional test in our highest court. With a law producing such splendid results and sustained by the Supreme Court, we can see no present reason why it should be altered in the slightest degree, and we earnestly recommend that no change or modification be made. Local objections must of necessity give way to the greater and more important interests of the State at large. The subject must not be considered from a narrow or local standpoint.

The following table represents the number of cases of Sacramento River salmon packed since 1890, and shows an encouraging increase:

Year.	Cases	Year.	Cases.	Year.	Cases.
1890	25,065	1895	25,185	1900	39,304
1891	10,353	1896	13,387	1901	50,064
1892	2,281	1897	38,543	1902	48,172
1893	23,336	1898	29,731	1903	64,430
1894	28,463	1899	33,227	1904	54,710

THE QUINNAT SALMON.

Extracts from "Report on Investigations in the Sacramento River, 1896-1901," by Cloudsley Rutter, Naturalist, U. S. Fish Commission steamer Albatross.

Value of Artificial Propagation.—Something of the value of artificial propagation can be learned from an experiment tried at Clackamas hatchery, Oregon. In March, 1896, 5,000 salmon fry 2.5 inches long were marked by cutting off the adipose fin. The eggs from which the fry were hatched were spawned at Baird hatchery in September, 1895. Mr. Hubbard, superintendent of Clackamas hatchery, who tried the experiment, reported that 375 of the marked fishes were taken in 1898. The smallest weighed 10 pounds, the largest 57 pounds, and the average was 27.7 pounds. Besides these, 5 were taken in the Sacramento River in 1898. A few more were taken both in the Columbia and in the Sacramento in 1899, and also in 1900. The 1900 specimens, however, may have been of those marked in the Sacramento in 1898. From these 5,000 fry 2.5 inches long, costing less than a dollar to produce, fish weighing over 5 tons were taken. That means for every female fish stripped at the hatchery the fishermen should catch about 5 tons three years later. About 400 of the 5,000 marked fishes were reported taken. We have no means of knowing how many came back to fresh water and escaped the nets, or how many were caught but not noticed.

Length of Life of Fall Salmon after Reaching Spawning-Grounds.—September 30, 1900, numbered metallic tags were attached to three male salmon, which were then released in the pool between the racks at Battle Creek fishery; 1 of these was found dead October 5th, having survived five days. October 22d, 36 others were tagged and released in the pool; 27 of these were seen at various times, some of them quite frequently, up to November 1st, and 5 of them were found dead within that time, the maximum time being ten days. On October 25th, 36 were tagged and released in the creek below the racks; 8 of these were found dead on the racks up to November 10th, a period of 16 days. Four were tagged and released in the mouth of the creek, about two miles below the fishery, on November 4th. One of these was seen on the 5th and again on the 8th, when it was almost dead, a period of four days. November 9th, 39 were tagged and released in the river below the mouth of Battle Creek; 3 were seen at the fishery on the 16th, 7 days afterwards. Altogether 12 tagged fishes were seen after dying, and the average time that they lived after tagging was 11 days. The longest time was 16 days; some had probably been in the creek a few days when tagged, although the freshest were selected. Two weeks is a very fair estimate of the length of life after reaching the spawning-grounds. Branded specimen No. 91, a female, lived but 8 days after reaching the spawning-grounds.

Death of Quinnat Salmon.—The salmon of the genus *Oncorhynchus* apparently has no instinct whatever to return to salt water after spawning. Worn-out specimens are sometimes seen drifting down stream and have been found as far down as Sacramento, though it is by no means certain that such have been on spawning-beds. In such cases they are simply too weak to stem the current and, according to a Sacramento fisherman, "not fit to look at." Dead salmon rarely float, although the current sometimes washes them along the bottom a short distance. I have seen dead salmon lie for several days in rapids and have seen them in all stages of decay in strong currents. Of the two hundred or more dead salmon that were marked and thrown over the upper rack at Battle Creek fishery in 1900, only two were carried to the lower rack, which was a half mile farther down stream. In small streams the water is often greatly contaminated by the dead fish, and the stench is a great nuisance to people living in the vicinity.

The great variation in size of spawning salmon, together with the occasional presence of certain scars, such as a broken nose, has led many people to doubt whether they all die after spawning once. The variation in size amounts to nothing as an argument, when we know that with about sixty marked fishes known to be of the same age, taken in the Columbia River in 1898, the variation in size was from 10 to 57 pounds. The broken nose could be received at many other times than when spawning.

It is sometimes thought that if a spawned-out salmon would float down stream to salt water it would revive, but such is not the case. Humpback and dog salmon often spawn in small creeks and brooks that empty directly into the ocean, yet they die like other species. They have been seen dying and dead in brackish water. The investigation of the blueback salmon or redfish in Idaho in 1895 (see Bulletin United States Fish Commission, 1896, p. 192), when a net was placed across the mouth of a small stream containing about a thousand salmon, proved that that species has no tendency to return to salt water after spawning. Lake Karluk, Kadiak Island, Alaska, is but about twenty miles from the ocean and is a great spawning-place for the blueback salmon. The outlet is shallow near the mouth, and if the salmon ever went back the Indians would be sure to see them, but they do not. In June, 1897, the shore of the lake for miles was lined with the bones of the salmon that had died six to eight months previously. The fact that all salmon of the genus *Oncorhynchus* die very shortly after spawning once can not be questioned.

THE TROUT LAW.

After careful consideration of the subject, we are of the opinion that it would be wise and beneficial to the trout interests to amend the present law, which opens the season for the taking of trout on April

1st, and substitute May 1st as the beginning of the open season. Only in a few of the coast counties are the fish through spawning by April 1st. In by far the greater part of our trout-bearing waters these fish have not finished spawning until May 1st, and in the higher altitudes not until June 1st. As the mountain resorts do not open before June 15th, and the campers do not make their appearance before the 1st of June, those sections will take care of themselves. In Lake Independence, one of the finest trout lakes of our State, the trout are threatened with extermination. Market fishermen reach there on snowshoes and begin their operations on the 1st of April, fishing through holes in the ice. As the fish have not yet begun to spawn, they take bait readily, with the result that thousands of pounds of spawn fish are shipped to market from Truckee every week, causing the loss of millions of eggs, which if allowed to hatch would produce thousands of fish for the angler and camper.

We would also recommend that the weight at which trout can be legally sold be increased from half a pound to one pound. As comparatively few above a pound are taken, it would have the effect of checking market fishing (excepting in some of the larger lakes), which would result in a better distribution of the fish. In other words, it would mean more fish to more people. Under present conditions the market fishermen pull out tons of spawning fish and ship them to the markets in the larger cities, where they command a price far beyond the average person's means, retailing at from 50 to 75 cents per pound. More of our people are going to the mountains every year; the number of anglers is increasing, and the increase is not confined to the wealthier classes. In many States of the Union the sale of trout is absolutely prohibited, but in our opinion the time for such action on our part has not yet arrived. We believe that sufficient protection and a more equitable distribution of the wealth of our streams will be attained by increasing the weight limit of trout that can be sold, from half a pound to one pound.

We would also recommend that a size limit be placed on the possession of young trout, by making it an offense to have in possession any trout less than five inches in length. In many of the coast streams young steelhead and other trout are taken by hundreds, varying in size from three to four inches. In the steelhead it represents the destruction of a fish that might reach a weight of twenty pounds. The taking of one such specimen is worth, as food and in sport, a thousand four- or five-inch fry. While such a law might not prevent the loss of all small fish, a large percentage of those returned immediately to the water will survive, and it would put a stop to the practice of loading up creels and barrels with baby trout.

EASTERN BROOK-TROUT.

(*Salmo fontinalis.*)

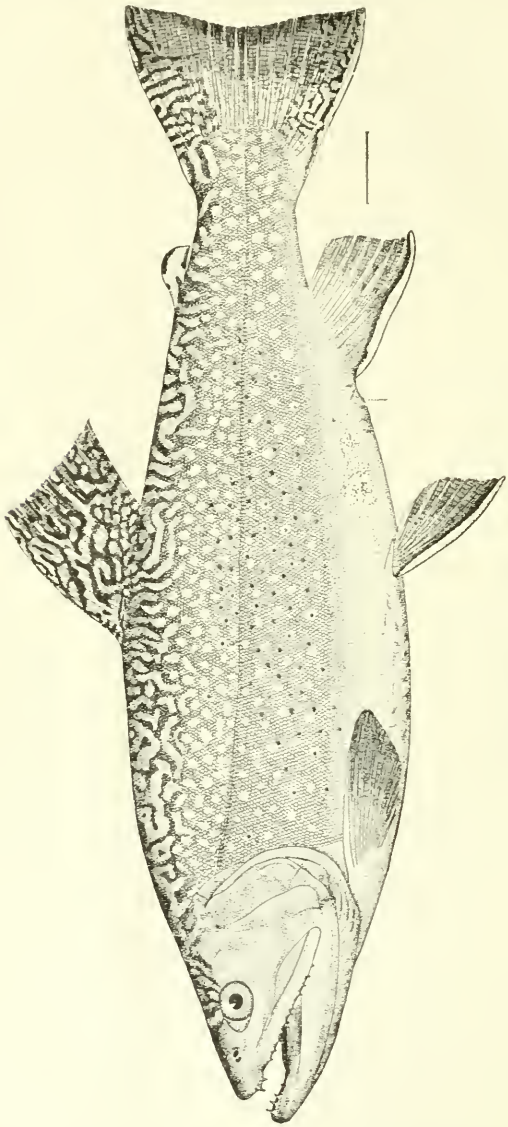
Our experiments with Eastern brook-trout are producing most gratifying results. We have for the past two years made, with the United States Bureau of Fisheries, an exchange of 200,000 of those eggs for an equal number of Rainbow eggs. Those we secured were sent from the United States station at Leadville, Colo., where they had been introduced from New Hampshire and Vermont some years previously. In 1903, at our Verdi station in Nevada, we hatched 92,000 fry from one half the Leadville consignment of 100,000 eggs. The fry were distributed in the small meadow streams and lakes in the Tahoe and Truckee regions. The remaining 100,000, from which 90,000 fry were produced, were hatched at our Sisson hatchery and were placed in suitable waters in the northern part of the State. Careful attention had brought good results from the comparatively small stock of breeders raised in the hatchery ponds at Sisson. From them we secured 320,000 eggs, giving approximately 480,000 fry from all sources for distribution in 1903.

In 1904 we secured another consignment of 200,000 Eastern brook-trout eggs from Leadville, and with still better results from our pond fish at Sisson we have distributed this year about 800,000 fry.

It is safe to say that better results have never come from any plants of fresh-water fishes made since this Commission was organized. From plants made in August, 1902—two years ago—specimens have been taken weighing two pounds. In Foulk's Lake, a small body of water near Verdi, Nev., specimens have been taken weighing upward of 2½ pounds. In the Tuolumne meadows they have attained a weight of 2 pounds in two years from the date of planting.

Remarkable results have come from plants made in August, 1903. In a series of small connected lakes, five in number, situated in the Tahoe region near Tallac, 25,000 fry were planted. On August 12, 1904, specimens were taken ranging from 8 to 9 inches in length. The fry had been planted in the small stream connecting these bodies of water and not in the lakes, but we were surprised and delighted to find by actual tests that they had spread out so that specimens were either seen or taken in each lake, as well as from the stream. As these lakes had never been stocked until these fish were carried there on pack animals (through the courtesy of Messrs. Comstock and Lawrence) and were known to be barren of fish life, and the specimens taken were all of the introduced and easily distinguished Eastern brook-trout, there could be no better demonstration of their remarkable development and adaptability to the cold waters of the high altitudes of the Sierra. Another striking example of their growth is afforded by the results following the planting of one can of 5,000 fry, six months old, in

August, 1903, in Watson Lake, a small body of water covering an area of fifteen acres, situated about five miles from Tahoe City, at an elevation of 7,000 feet. In that lake a plant of Cutthroat fry was placed in



EASTERN BROOK-TROUT—*Salvelinus fontinalis.*

1902, or one year earlier than the Eastern brook-trout fry. In August, 1904, specimens of both fish were taken. The former showed for two years' growth a maximum length of 8 inches; the latter showed in one year's time a maximum length of 10 inches, and the proportion of

Eastern to Cutthroat taken was two to one. We have retained specimens of these fish taken from each place, and they can be seen in our office.

These positive examples have confirmed our judgment of the value of these fishes, as expressed in our report of 1901–02; and with the splendid stock of "breeders" at Sisson, now rapidly increasing, we confidently expect to have in two years' time an annual output of 1,500,000 fry.

In addition to the plants made in the higher altitudes, we began to test their adaptability to the head waters of some of the coast counties, and while the exceptional growth in the Sierra have not been duplicated, reports from plants made last year indicate that they have shown as good results as any other variety of trout planted in former years, with the distinct advantage that instead of drifting down stream to salt water, they work up stream and remain in fresh water. Being "fall spawners," which means that they spawn late in the year, beginning generally in the early part of November and continuing into December, they are in prime condition to take when the open season commences. As they rise to a fly or take bait equally well, and will remain where planted, no matter how small the brook, they fill an important place in waters left vacant by Rainbow or Cutthroat trout, neither of which is naturally found there, nor will remain when planted there. It is believed, however, that in streams subject to sudden rises during winter freshets, they can not show an increase through natural propagation, both the eggs and young fry being easily destroyed by torrential floods, which are to be expected during the hatching and rearing periods; therefore, we would not advise their planting to any great extent in the Coast Range streams, except it be at the headwaters or in lakes and reservoirs that are not subject to much change.

STRIPED BASS.

During the legislative session of 1903 our recommendations that the weight limit on bass that could be lawfully taken be changed from one pound to three pounds, and a continuous open season for their capture be granted, became a law. We are pleased to report a decided increase in the numbers of this fish. Not only is the striped bass one of the most palatable and nutritious of our food fishes, but it is second in value and importance to salmon. We are importuned by some dealers to have the weight again reduced to one pound, this request usually coming during the time of a prosecution for a violation of this law. Some of the larger dealers go so far as to claim that unless the limit is again reduced, striped bass will become as plentiful and cheap as shad, which period, in our opinion, could not arrive too soon. It is a note-

worthy fact that many of our citizens solicit from the dealers young and immature fish, ranging from half a pound to one and a half pounds, which they regard as a great delicacy. On the other hand, in their native waters the small fish are not regarded with favor. In the wholesale markets in New York and other Eastern seaports where striped bass are found, they are graded into three classes, known as pan, medium, and boiling. The latter is the largest size, and invariably commands twice the price per pound that obtains for the smaller or pan fish. The anglers of our State have discovered the prime sporting qualities of this fish, and their interest in consequence has become much aroused. They ask that a close season be established for two or three months. Thus it is seen that the views of the marketmen and of the sportsmen are widely divergent. Between them we think there is a happy medium, and that is, to allow striped bass to be taken at all seasons of the year and the three-pound limit maintained as at present. The size of mesh that would of necessity be required to take one-pound fish would destroy all others of less weight that get into the net. However much the fishermen might try to respect the law, the mere weight of the catch would crush to death those weighing from a few ounces up to a half pound. This loss is serious when it is understood that these small fish have already escaped most of the vicissitudes incident to their lives, and that if not artificially destroyed they would in a few years attain a weight of forty to fifty pounds.

In the past four years a great many striped bass clubs have been organized and there are thousands of our people who not only have sport but are able to furnish their tables with a most desirable food fish. On any Sunday or holiday thousands of these anglers may be found along our bay shores and along the San Joaquin and Sacramento rivers as well as their tributaries. Striped bass weighing twelve pounds have been taken in the clear waters of Feather River above Oroville. They are found in large numbers in the Tuolumne River above Modesto, in the Merced River, and in the San Joaquin River they have been found as far up stream as Pollasky. Naturally, as in all fishing, there are days when the angler and the fish do not connect. Then the idea occurs that perhaps too much liberty is allowed the net or market fishermen. The anglers advocate a close season during the spawning season of these fish. In our opinion this would be both unwise and unnecessary. Unwise because it would be an absolute impossibility to catch salmon and not kill the large striped bass, ranging from 20 to 50 pounds, that are caught in the same net with the salmon.

If a close season existed it would be an offense to sell or have striped bass in one's possession. The fishermen would be compelled to throw them away; thus their value as spawn producers and as a food supply would be lost to the people. In fact, during such close season tons of

a valuable food supply would be wasted daily. It is unfortunate that the spawning season of striped bass occurs at the time the spring run of salmon enters our rivers. When the fishermen are receiving from 5 to 7 cents per pound for salmon, the price for striped bass is from ¾ to 1½ cents. If then a close season were established, it would mean that thousands of poor people who depend largely upon fish and who buy striped bass would be unable to obtain them and would have to buy other fish, inferior or more expensive, resulting also in an increased demand for salmon, with attendant increase in price thereof.

As the great value of the striped bass unquestionably lies in its commercial and economic importance and not in its qualities as a game fish, and while under the present law the supply is not only maintained but is steadily increasing, we can see no valid or substantial reason for changing it in any particular.

Wide as the range now is for striped bass, it is still confined to the interior bays and rivers. It is a remarkable showing that from a plant of 400 fingerlings made at Army Point, Solano County, in 1882, market sales approximating 2,000,000 pounds were made in 1903. They have not gone far north or south of the Golden Gate. Russian River, in Sonoma County, seems to be almost the northern boundary line, and Monterey Bay the southern. These fish adapt themselves so readily to fresh water that it appears that the long voyage they would have to make through salt water to reach other fresh-water streams is too great for them to accomplish. To overcome that long journey, we have made plants both north and south. The southern plant was made in Orange County in December, 1903, in a series of brackish lagoons fed by fresh water. This plant was remarkable for the size of the fish that were transported in safety. J. H. Davis and M. L. Cross, two of our experienced deputies, were placed in charge of this work. They collected about seventy-five bass, ranging in weight from six ounces up to three and one half pounds. The fish were segregated as to size, were held in live cars for thirty-six hours, and then were shipped in twenty-gallon fish-shipping cans, a distance of nearly 700 miles, reaching their destination without the loss of a single fish. It is hoped and believed that these fish will gain a permanent foothold in southern California, and not only be found in the mouth of the Santa Ana River, but will reach San Diego Bay. We have also arranged to make a substantial shipment of striped bass to Del Norte County. The District Attorney, Board of Supervisors, and some of the leading citizens of that county wish to add a desirable fish to their food supply, and have asked for black bass, which is exclusively a fresh-water fish. We concluded, after having received descriptions of the waters, which range from salt and brackish to fresh, that striped bass would give better results, and we hope to see this fish firmly established in Del Norte County before the winter.

SHRIMPS.

During the session of the Legislature of 1903, persistent efforts were again made by interested parties, acting on behalf of the Chinese shrimp companies, to amend the present shrimp law, enacted during the session of 1901, whereby a close season of four months (May, June, July, and August) was established. Judging from the determined attacks made at that time to reduce the open season, and from the number of petitions that have since come to this office, as well as from the various inducements held out to our deputies to ignore the provisions of the present law and allow the Chinese shrimp fishermen to follow their destructive methods, we feel that the report on the operations of shrimp fishermen, published in the Fish Commissioners' Report of 1899–1900, should be again printed, in order that this matter may be clearly understood. This report was made by N. B. Scofield, of Stanford University, who was indorsed and recommended to the Board of Fish Commissioners by Dr. David Starr Jordan. Mr. Scofield was regularly in our employ and carried on his investigations for a period of several months. The report is as follows:

The Chinese shrimp boat is of Chinese make and pattern, and is 40 feet long by 10 feet on the beam; it carries a 30-foot mast, which bears a typical Chinese sail. The crew is invariably made up of five men.

The fishing is done by means of bag nets made in China expressly for the shrimp fishing. Each net is about 20 feet across its mouth, and narrows quickly into a narrow bag about 40 feet long. The end of the bag is open, so that the contents of the net can be easily let out by untying a string which holds the opening closed. Near the mouth of the net the mesh is large (about 2-inch), but it gradually grows smaller till in the last half of the bag the mesh is ½ inch.

Each boat operates from twenty to thirty nets, which are set on the bottom with their mouths against the current. Some position is selected in the channel where the current is strong, and here a line is stretched across the current—lying on the bottom and anchored at either end and occasionally in the middle—the position of the anchors marked by buoys. The nets are set along this line, usually at low tide, and are taken up again at the next high tide; depending on the current to drift the shrimps into the nets.

By a special contrivance the nets can be set and taken up without the anchors by which they are held in place.

In drawing in the nets the fishermen pull up one end of the line to which the nets are attached and pass it over a pulley at the bow of the boat and reel it in by a windlass in the stern. As each net comes up to the surface at the bow of the boat, it is unfastened from the line and carried around to the side of the boat, where it is pulled up by hand and its contents dumped into the boat. The nets are taken ashore and dried, and at the next low tide a second set of nets is taken out, each boat having two sets.

The number of shrimps caught by each boat varies greatly. At some time they catch only a couple of baskets, which weigh about 90 pounds each; at other times, when everything is favorable, they catch as high as eighty baskets. These numbers include everything caught.

The shrimps when brought into the camp are first boiled in large open vats. Salt water is used for the boiling, coarse salt being added in large quantities. After boiling about thirty minutes they are spread out on the ground to dry. After they are sufficiently dried they are swept together and rolled thoroughly with heavy cleated rollers.

which break the shells away from the "meat" of the shrimp. Then, after a process of alternate sifting and beating and picking over by hand and running through a fanning mill, the "meat" is gotten out. For this dried shrimp meat the fishermen get 8 cents a pound in San Francisco. The shells and other impurities are saved and are made use of as a fertilizer, and with the rest of the shrimp product are sent to China.

A few shrimps are taken at the San Rafael fishery and sent fresh each day to the San Francisco market.

The time of setting the nets varies. Sometimes the best catch is made while the tide is running out; at others, the catch is equally good for the outgoing and incoming tide—due probably to a general movement of the shrimps, independent of the current.

When the catch is large the men stay at the nets and pull them in every hour or two.

The average catch per day for each boat at the San Rafael fishery during the last two weeks of July was 70 baskets, each basket weighing about 90 pounds, making in all 6,300 pounds. The average number of boats out each day was seven, making in all a daily catch of 44,100 pounds. For fifteen days this number is swelled to 661,500 pounds. One half of this consisted of small fish, principally of the following species: *Osmerus thaleichthys* (smelt); *Engraulis mordax* (California anchovy); *Porichthys notatus* (midshipman); *Leptocottus armatus* (sculpin).

The small *Osmerus thaleichthys*, about 2½ to 3½ inches long, were very abundant, making up over one fourth of the entire catch. The estimated amount of these young smelt taken in the last fifteen days of July is 165,375 pounds, or about 16,537,500 small fish. It is more than probable that this particular smelt is the principal food of the young salmon descending the Sacramento River.

When the nets come to the surface of the water these small smelt are dead, so that to throw them back would do no good. The only way to prevent this destruction would be to stop the fishing entirely during the time from April to October when these fish are so abundant.

The Chinamen save a good many of these young smelt, drying them on trays. They say they get 10 cents a pound for them.

During July they caught but few flounders. These were saved and dried, along with a few sculpins, etc., which are not eaten by any one else. During May and June the catch of flounders is very much greater than at the present time.

The same conditions that existed at the time this report was written, prevail to-day. There has been no change in the method of taking shrimps, and the same reasons that existed for continuing the present close season exist more strongly to-day, because as our population increases there is a greater demand for fish. Therefore, we can less afford to have the young fish—a future food supply—destroyed.

The Chinese are the only people represented in the capture of shrimps, and they would like to see the present close season reduced by one or two months. They have made strenuous efforts to abrogate or amend this law, which perhaps would not have been attempted were it not that they, as for some years past, have been made the victims of designing whites. The voluminous petitions for such amendment, which have been presented to us, on examination proved to be signed largely by fictitious names, and by others who, we believe, possess not the slightest information on the subject of shrimps or the destruction of young fish that follows their capture.

It is well understood that to supply the local demand for fresh shrimps, not more than five or six boats would find the occupation profitable. We have suggested that the exportation of dried shrimps

be prohibited, which would reduce the number of boats engaged in this work about three fourths. The State could then, without much injury to our general fishery interests, grant a continuous open season. The shipping of dried shrimps and dried young fish to China is profitable, for which reason the proposed amendments are urged by those interested.

Since the refusal of our Supreme Court and of the United States District Court to issue writs of habeas corpus in cases of arrest of shrimp fishermen by our deputies, only one legal effort has been made to nullify the law. An appeal to our Supreme Court was made on the ground that a constitutional provision had been violated when the Legislature included fish and game under one title. This effort was distinguished chiefly by the force and brevity of the opinion of a unanimous court, which held that "the preservation of fish and game is a single subject of legislation, and may properly be embraced in the same act."

We firmly believe that this law should not be disturbed, for the following reasons, which were given in our preceding report: "Because not a single citizen of our State has suffered by its operations. Not only has there been an ample supply of fresh shrimps for our markets, but millions of young fish have escaped destruction, and are thereby enabled to attain a marketable size, which contributes to the benefit of all our people and tends to destroy a Chinese monopoly. As every interest of the commonwealth relating to fisheries has been subserved, and only the export trade of the dried shrimp and small fish to China has been decreased by this law, we would most earnestly recommend that it be continued on our statute books indefinitely."

CARP.

With so many superior food fishes at hand, it is not strange that our people regard the carp with disfavor. Notwithstanding they are found in all our markets, they are sold principally to the Chinese. The Fish Commission has often been criticised for introducing this fish into the waters of this State. In our opinion, carp have been a benefit rather than a detriment: not as a food supply for the people, but because of the food they furnish for better fishes. The first carp, about seven hundred in number, were brought into this State in 1875, not by the California Fish Commission, but by United States Fish Commissioner Spencer F. Baird, who expended a portion of the appropriation made by the Government in the importation of European carp. They were brought from the regions of the upper Rhine, the Danube, and the Po rivers in Europe. In 1877 we, in exchange for California trout eggs, received from the Department of Agriculture of Japan about eighty specimens of Japanese carp, which were placed in the aquarium

at Woodward's Gardens in San Francisco, with a view of planting them, when they had arrived at maturity, in certain waters of this State; but no specimens were ever taken, therefore the only carp we have are those which were introduced from Europe by the United States Fish Commissioner. They are a most prolific fish. The ovary of a female has been known to contain half a million eggs. Like most introduced fishes, they make unusual growth when transplanted, reaching a weight of two pounds in one year.

It is charged that carp are destructive of other fishes. There is no evidence to support the claim. Nature did not intend the carp for a fighter when she gave it a sucker mouth. The carp is, like the sucker, a scavenger of the waters, living on decayed vegetation and refuse that other fish refuse. We have planted small black bass fry in bodies of water that fairly swarmed with carp. In a few years the bass had the upper hand. Being furnished with an abundant food supply, they increased rapidly, while the carp showed a corresponding decrease, only the larger ones seeming to survive. Wherever carp are found we plant black bass, and at the present time the black bass have firmly established themselves in all such waters.

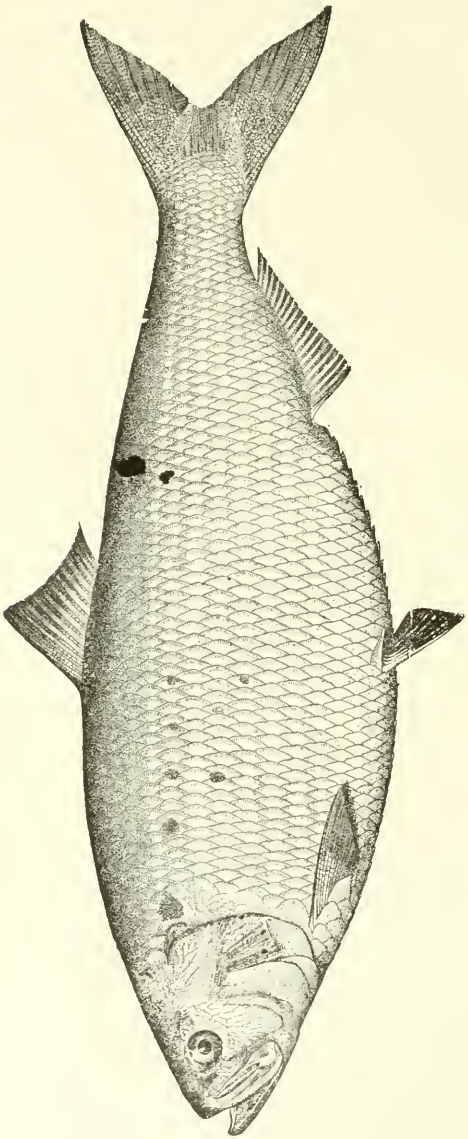
While our people look upon carp with contempt, they are still propagated in a number of the Eastern States, especially in Illinois and Massachusetts In the wholesale markets of New York City this fish commands a price varying from 2 to 9 cents per pound, and is handled in large quantities. The same can be said of the Chicago markets. In our State its greatest value lies in furnishing a never-failing food supply for our black bass and striped bass. These facts are mentioned to show that the carp has a value here as elsewhere and that its introduction into our waters was not a mistake.

SHAD.

This fish is considered the most valuable river fish of the Eastern seaboard. Our people are beginning to appreciate the quality of the shad and apparently better understand how to prepare it for the table. The objection, "It is so bony," so frequently heard, is becoming less common. The supply continues in excess of the demand to such an extent that market fishermen are limited in their catch by the principal dealers. At certain seasons of the year the markets are flooded with shad and they are sold at less than 5 cents each, regardless of weight.

For the first shad taken in our waters, a bonus of $50 was paid, which was on May 10, 1873. In 1874 sixteen full-grown shad were taken at Vallejo. Since that time this fish has become so firmly established that no legislation is necessary for its protection. The original

plant of this variety was secured for the California Fish Commission by the eminent fish culturist, Livingston Stone, and were contributed by the State of New York from the State hatching works on the Hud-



SHAD—*Alosa sapidissima*.

son River at Castleton, at that time in charge of Seth Green, who is recognized as one of the pioneer fish culturists of this country. Two plants, aggregating 50,000 fry, were brought to California and distributed in the Sacramento River at Tehama, the first on June 27, 1871.

From these small plants the increase has been so great that shad are now found not only in the Sacramento, but also in the San Joaquin, American, Feather, and other rivers, as well as in all the large bays. At certain seasons of the year shad affords an important food supply to many of the farming population who live along the banks of these streams.

CATFISH.

The catfish that were first introduced into this State came from the Schuylkill River, Pennsylvania, and the Mississippi River at Omaha, in 1874, thus giving us two varieties. Both were planted in the San Joaquin River near Lathrop. The demand for this fine-flavored fish continues to grow, and there is danger of the demand exceeding the supply. Catfish find considerable sale in the San Francisco markets, but the bulk of them is handled at Sacramento, where the shipments reach two tons in a single day. From that point they are shipped south to Arizona, north to Oregon, and east as far as Kansas. Occasionally complaints are made that the catfish is destructive of other fishes. With that contention we do not agree, the best evidence to the contrary being the increased number of striped bass, black bass, and shad found in the same waters with the catfish.

SPINY LOBSTERS OR CRAWFISH.

The crawfishing industry has not yet recovered from the exceedingly long open season that existed on our statute books for so many years, and the present restrictions are not sufficient to allow for any increase in the numbers of this fish. We are therefore inclined to recommend a close season on this fish for a period of two years. If the Legislature considers this restriction too great, we would urge that the close season be extended from August 15th to September 15th, or one month longer.

The principal crawfish camps are found on Anacapa and Santa Cruz islands, in the Santa Barbara channel, and on San Nicolas and Clemente islands, off the coast of Los Angeles County. There are approximately forty crawfish camps, each one of which handles from thirty to forty traps. The more intelligent of the fishermen engaged in this work are in favor of a close season for a period of two years. They seem to believe that it is the only way in which the industry will have a chance to be restored, and in our judgment this would be the proper remedy.

STURGEON.

In our judgment the time has not arrived for any modification of the law relating to the taking of sturgeon. In other words, we would urgently request that the present close season be maintained. This fish is beginning to show an increase in numbers, but, in our opinion,

not sufficient to justify its capture for at least some years to come. The passing of this fish is a striking example of what unrestricted capture may mean to any of the food fishes in our waters. At one time sturgeon were so plentiful that they had no market value, but by reason of wasteful methods, they became one of the highest priced fish in the markets, quite beyond the means of the masses. During the past two years this Commission has made a number of arrests and secured convictions for the possession of sturgeon roe as well as of the fish themselves. There were no systematic efforts made to continue these violations, but spasmodic attempts to take advantage of conditions and bring a few fish into market under cover. The artificial propagation of this fish, which has been carried on to a limited extent in this country, and in Germany and Russia, has met with but moderate success, it being an extremely difficult matter to catch such large fish and retain them until they have reached the proper degree of ripeness at which they can be spawned. The work of artificial propagation being attended with considerable expense, and other desirable food fishes, such as shad, striped bass, and black bass, having become so abundant, we believe that the restoration of the sturgeon can be effected through the slower but inexpensive way of natural increase.

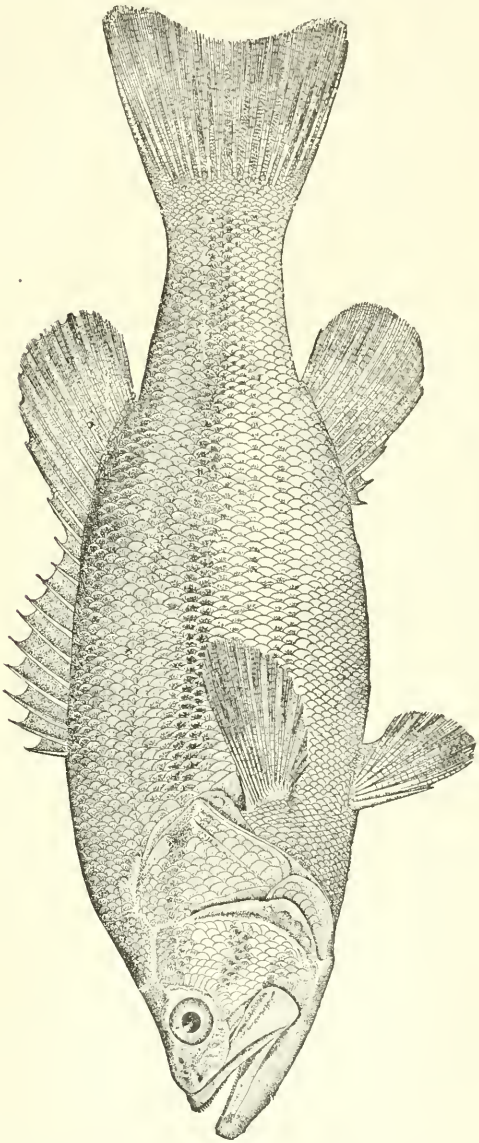
ABALONES.

During the last session of the Legislature a vigorous attempt was made by interested parties to reduce the restrictions that were, in 1901, placed upon the taking of abalones. Notwithstanding that there was but one firm represented in this contest, and that its employés are principally Chinese and Japanese, a great deal of influence was brought to bear and many compromises were offered, but the representatives from all the counties along whose shores these fish are found were firmly united in favor of retaining the present law without amendment, and refused to recede one iota from their position. Indiscriminate and unrestricted fishing had almost exterminated these fish, and it is yet too soon to permit any concessions. Generally speaking, the law has been respected. Our deputies have made a total of seventeen arrests and succeeded in getting convictions in nearly every case, showing that public sentiment in the counties where these fish are found is against any change in the present law.

BLACK BASS.

The work of collecting black bass and of distributing them to suitable bodies of water throughout the State has been carried on faithfully and intelligently. In the fall of 1902 we planted upward of 3,000 adult fish, all of which, with few exceptions, were taken from the Daly pond, in El Dorado County, seven miles from Folsom, and were captured with

hook and line, using a Wilson spoon as a lure. Out of this number of fish taken by that method we lost but four, and these died at the end of a long trip after the fish had been held in live cars or shipping cans for



LARGE-MOUTH BLACK BASS—*Micropterus salmoides.*

three days and nights. In the fall of 1903 we did not collect as many fish as we expected. Owing to the large run of salmon, and the enormous take of salmon eggs, our force of experienced men was kept busily engaged in that more important branch of the work for two months

later than usual. Our efforts at this late date to capture black bass with hook and line were not successful, because, while we were able to get many large fish, they would not bear transportation so well as fish ranging in size from four to eight inches. The smaller fish had left the shallow water and shoals to pass the winter in deeper water. We were enabled, however, to fill a number of applications and stock some large bodies of water; one in particular in Amador County, where they have increased wonderfully. In fact, the good work done in previous years has resulted in such great development that we believe we are justified in asking the Legislature to grant at least six weeks additional open season, making it lawful to take these fish beginning May 15th instead of July 1st.

In all the sloughs, lagoons, and lakes in San Joaquin and Sacramento counties these fish are found in great abundance. The high water during the past winter left many of them landlocked. All such would have perished when the water receded; but, through the intelligent and untiring efforts of George Neale, Game Warden of Sacramento County, who gave us valuable assistance, we have been able to collect, at very little expense, a large number of them, which we caused to be transported to suitable waters in Tulare, Madera, Solano, San Joaquin, Monterey, Santa Barbara, and San Luis Obispo counties. One large plant of 300 adult fish has just been placed in Crane Valley Lake, in Madera County, the headwaters of the San Joaquin River, without the loss of a single fish. During this fall we expect to collect many more from the waters around Sacramento, to fill applications now on file.

As a courtesy to the State of Nevada, and in recognition of their kindness in granting us permission to take Rainbow spawn in the Truckee River in that State, we made a large shipment of these fish into Nevada, some of which were planted in the reservoir furnishing the water supply for the State University. A plant was also made in Wheeler's Lake, a large body of water in Washoe County that contains many carp; it is eminently adapted to bass, but would not support trout life. Still another plant was made in the lower reaches of the Humboldt River, where carp and catfish are found in large numbers, but being far below the range of trout. We confidently believe that in two years the people of the State of Nevada will find that they have an additional food supply in the shape of a fish that can not be excelled for table or gamy qualities.

We have declined many applications for black bass, and have furnished the reasons to the applicants why it was inadvisable to plant black bass in trout waters. The experience of the United States Fish Commission fully bears out our judgment in this matter. Trout and black bass are two of the highest grade of sporting fishes. Each is jealous of the other, and therefore antagonistic. Placed in the same body of

water, they prey upon each other continually, with the result that neither increases in the same ratio that would be the case if separate waters were given to each variety. There are many large bodies of water in the lower elevations where the temperature of the water rises above what trout can endure, but where black bass find a most congenial habitat, so we believe that there is no occasion for putting these two kinds of fish in the same waters. On the other hand, the large-mouth black bass, which is the variety we are handling chiefly, shows no perceptible increase in the colder waters of the higher elevations. It is noteworthy that black bass flourish and retain all their good qualities as an edible fish in the same waters where carp exist, the difference in quality being due to the fact that the food of the carp is largely of a vegetable character, whereas black bass live upon the young of inferior fishes, such as carp, minnows, suckers, etc.

In this State many artificial lakes and reservoirs are being created each year for purposes of irrigation or power. It is our policy to make these storage places of still greater value by planting black bass in them, thereby bringing an additional food supply within reach of many of our people who can not afford the time or have not the means to go to the mountains for trout, and the taking of which will afford them a great deal of sport. Some years ago two plants of black bass were made in Clear Lake, Lake County, but they were lost sight of until in the past two years, when they began to show a marked increase. Large schools are frequently seen in different portions of the lake, and where the carp had the upper hand the black bass are now in the ascendancy. We find the same result has followed the planting of black bass in other waters that were infested with carp—the black bass increase and the carp diminish, only the adult carp being found. As it is the young carp that furnish a food supply for the bass, therefore we contend that while the carp does not rank high as a food fish and is largely condemned, it plays a very important part in the economy of nature by furnishing a means of subsistence for a better fish.

THE GRAYLING.

Through the courtesy of Hon. George M. Bowers, United States Commissioner of Fisheries, we were able to secure from Bozeman, Montana, a shipment of grayling eggs, which were hatched at the Sisson hatchery, and some 7,000 fry resulting therefrom are now in the rearing ponds. This marks the first effort of the California Fish Commission to introduce this beautiful fish into our waters. According to Dr. David Starr Jordan, there is but one genus, *Thymallus*. The grayling is found throughout northern Europe as far south as the mountains of Hungary, where it has been called "the flower of fishes." The name *Thymallus*

was given by the ancients, because the fish, when fresh, was said to have the odor of water-thyme. The chief distinctive peculiarity is the great development of the dorsal fin, which has more rays than are found in any of the *Salmonidæ*, and the fin is also higher, besides which it is specially marked with purplish or greenish bands and bright, rose-colored spots, while the body is purplish gray, with spots of black. Most of the species rarely exceed a foot in length, although graylings weighing five pounds have been taken in England. The American grayling (*Thymallus signifer*) is widely distributed in British America and Alaska. A similar form, called *Thymallus montanus*, occurs in the Gallatin, Madison, and other rivers of Montana, tributary to the Missouri. It is locally still abundant and one of the finest game fishes. In all countries the grayling frequents clear, cold brooks and rarely if ever enters the sea or even the larger lakes. It congregates in small shoals in the streams and prefers those which have a succession of pools and shallows, with a sandy or gravelly rather than a rocky bottom. It is non-migratory in its habits, depositing its ova in the neighborhood of its usual haunts. The ova are far more delicate and more easily killed than those of the trout or charr. The grayling and trout inhabit the same waters, but not altogether in harmony. As a food fish the grayling ranks high, and is beloved by sportsmen. It is considered a gamy fish, although less strong than the brook-trout and perhaps less wary. It is believed that suitable waters for the introduction of this fish can be found in the vicinity of Mount Shasta, perhaps in the upper reaches of the McCloud River.

LANDLOCKED SALMON.

(*Salmo sebago.*)

We are pleased to report that through the courtesy of the United States Fish Commission, another shipment of landlocked salmon eggs was sent to us from Greenlake, Maine. In 1895 a shipment of these eggs was received, but they reached here in poor condition, and the fry resulting therefrom were weaklings. However, they were planted in a lake near Cisco, in the Sierra Nevada Mountains, and a few hundred in a small lake in the Tahoe region. A few specimens have since been taken. While our first experience was not considered a pronounced success, it was sufficient to establish the fact that this fish will adapt itself to the cold waters of lakes in high altitudes, of which there are many hundreds throughout the Sierra Nevada Mountains. In its native waters it grows to immense size. In 1901, a specimen was taken in Sebago Lake that weighed twenty-three pounds, but the average weight is about ten pounds.

We received 10,000 eggs, which reached us in splendid condition, and about 9,600 strong, healthy fry resulted from the hatch. An additional

supply was added to the lakes that were stocked in 1895, but we reserved 3,000 at our Sisson hatchery for the purpose of studying their development and for use as breeders.

SLAG.

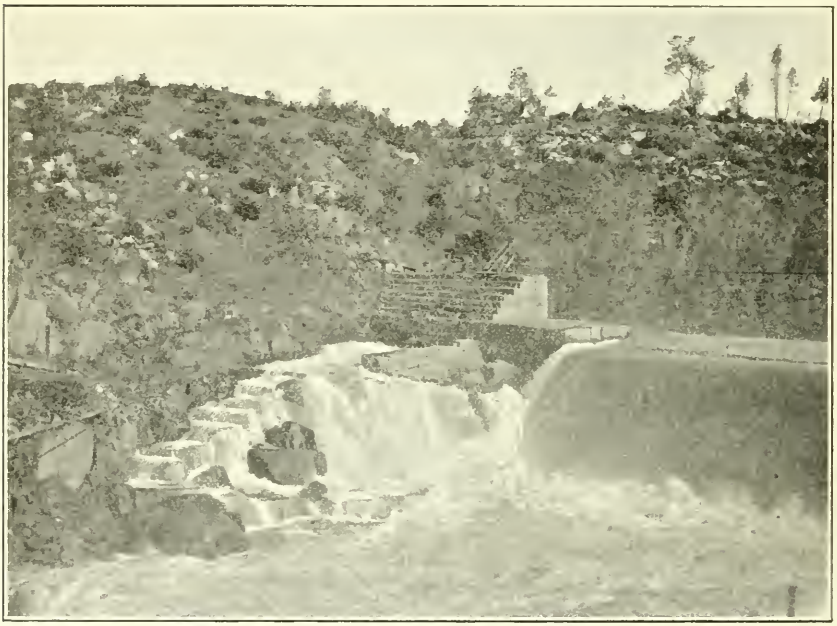
We are pleased to report a total absence of slag in the Sacramento River. The Mountain Copper Company at Keswick has not only faithfully carried out its agreement with us in regard to making extensive changes and improvements in its methods of handling slag, which involved an outlay of approximately $30,000, but it has since maintained its plant in such shape that slag does not reach the river. As a result, catfish, striped bass, and shad are found in considerable numbers above Redding and pass the point at which the slag formerly entered the river. Due credit for this improved condition has been given to the State Board of Fish Commissioners by the newspapers published in the upper Sacramento Valley, as well as by the people living along the banks of the river, who have been enabled to add something to their food supply and much to their sport by the increased runs of fish.

FISH-LADDERS.

Since our last report was made, a great many complaints have been investigated regarding defective and inefficient fish-ladders, and many new ladders and fishways have been constructed. There are still in existence a number of old fish-ladders constructed in accordance with plans that were furnished many years ago. Experience has taught us much in regard to the manner of construction and the proper location of fishways. Wherever it has been possible we have cut a "run round" in the solid rock or earth around one end of the dam. We have learned that fishways which approach natural conditions as nearly as possible are more readily used by the fish than anything of timber construction. They have also the advantage of being permanent. Those constructed of timber, unless they are carefully watched and a proper supply of water is maintained, deteriorate rapidly and become so weakened that an unusual rise of water is apt to carry them away and leave a dam impassable for another season.

Among the more important fishways that have been constructed in the past two years are two on the Merced River (one in Merced County and the other in Mariposa County), and three on the Stanislaus River (the first at Knight's Ferry, the second at Six-Mile Bar, and the third at Melones, Calaveras County). Certain improvements are now under way to make the one at Melones more efficient. In Sonoma County, on Big Sulphur Creek, and in Alpine County, on the Carson River, fishways have also been constructed.

But the most important, considered from an engineering standpoint, is the fishway constructed through solid rock over a dam in the American River at Folsom. The problem there presented was unusual. The obstruction to be overcome was approximately 60 feet in height. The expense of this work was borne jointly by the Sacramento Gas and Electric Railway Company and the State Prison at Folsom, the prison authorities furnishing the labor, and the Electric Company furnishing tools, cement, powder, and the services of an experienced engineer to direct the work. Through the courtesy of the honorable Board of State Prison Directors, 1,200 days of convict labor were granted, this being



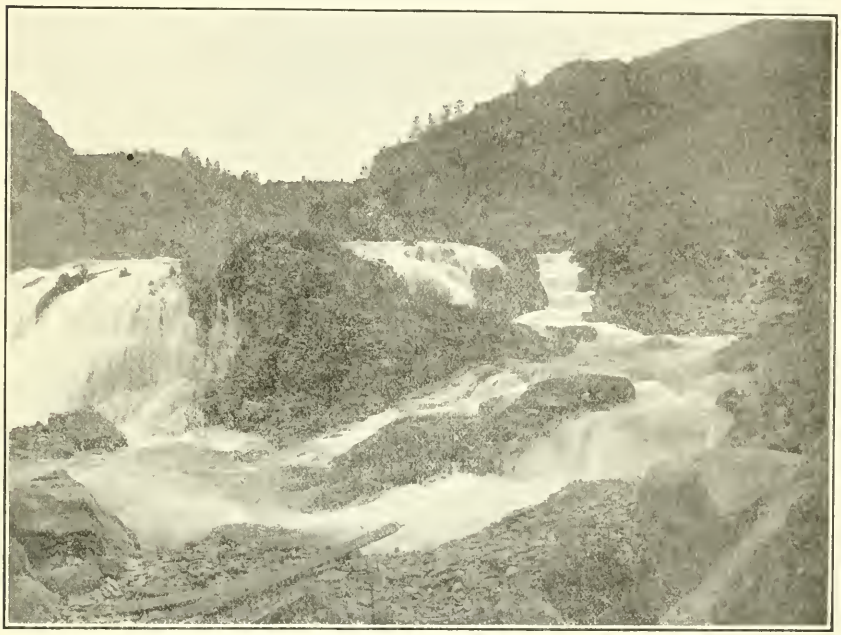
FISHWAY AT FOLSOM DAM, AMERICAN RIVER.

Shown at a high stage of water. Fishway, 310 feet long, forming two sides of a triangle, apex down stream. Pools, 8 by 10 feet, and 3 feet deep.

the contribution of the State to this important piece of work. The State being one of the beneficiaries of this dam, receiving the first "drop" of the water diverted for power to operate certain machinery connected with the State's penal institution, we felt justified in asking of the Prison Directors that they furnish the necessary labor. Our request was cheerfully granted. Shad being the principal fish that frequent the American River at this point, an unusual fishway had to be constructed to enable them to ascend such a high obstruction. To have enabled salmon to pass would have presented a simpler problem. The work has been satisfactorily completed according to our plans, but we

believe there still remains a small amount of work to be done at the upper end or outlet, which, when completed, will leave a permanent fishway and one as efficient and nearly perfect as could be constructed around an obstruction of such height.

In our Seventeenth Biennial Report, we referred to the Pit River fishery, for which the Legislature of 1901 had appropriated the sum of $3,000. This appropriation not being available until January 1, 1902, we were unable to take any steps, beyond a preliminary survey, until August of 1902, the water then being at its lowest stage, at which time



PARTIAL VIEW OF PIT RIVER FALLS, SHOWING FISHWAY.

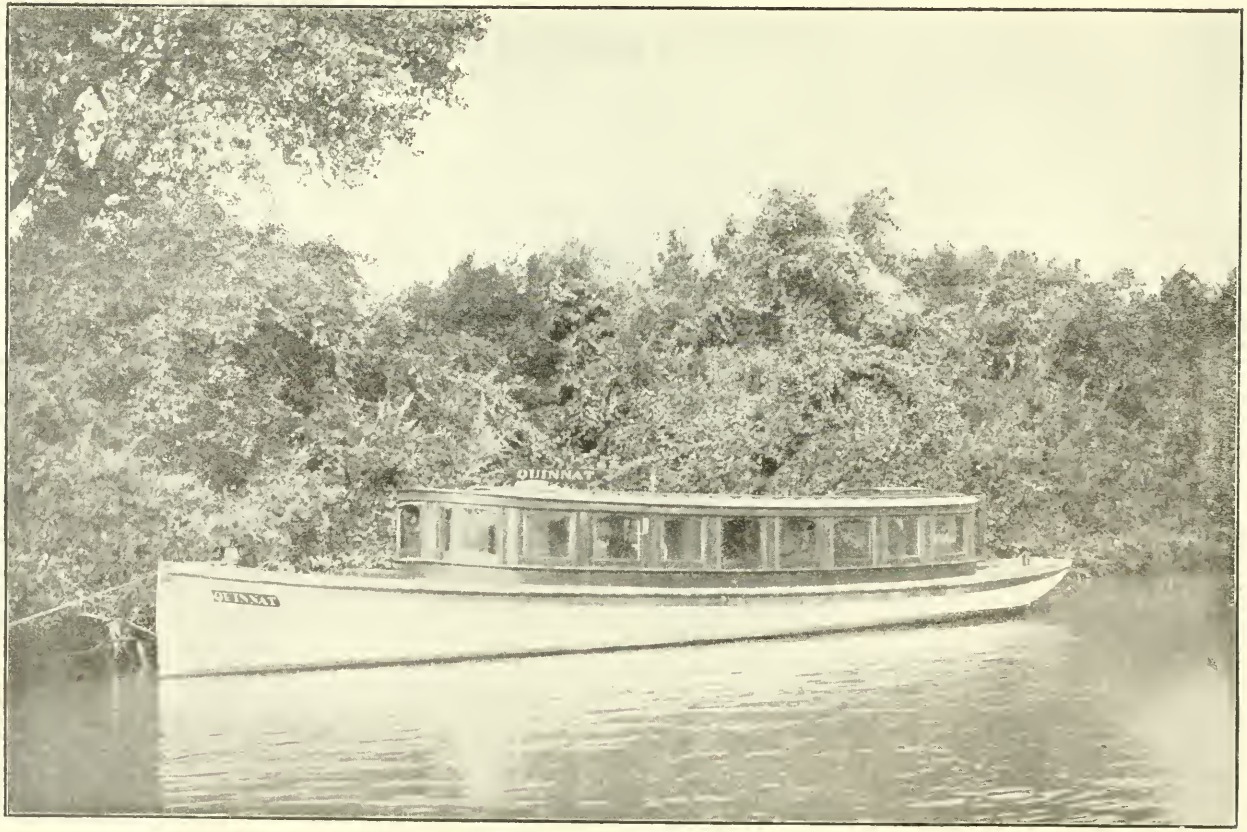
Height of falls, 42 feet; length of fishway, 320 feet; average width, 10 feet; highest leap for salmon, 34 inches. Approximately 2,000 inches of water was flowing through fishway when picture was taken.

the work could be most economically done. We have since carried out faithfully the terms of that Act. The surveys were made by W. H. Shebley, Superintendent of the Sisson hatchery. Bids were called for and four or five were submitted. The lowest bidders were Messrs. Keener and Brown, of Carbon, Shasta County, to whom the contract was awarded. This work was completed and accepted on November 1, 1902, on which day Chief Deputy Vogelsang and Superintendent Shebley turned the water of Pit River through the newly constructed passageway for salmon. That the work was well done is evidenced by the fact that within two weeks after the water was diverted into the

fishway, large numbers of salmon were found in Fall River, at a point many miles above the falls, which was the first time they were seen in any numbers in those waters. This can be substantiated by William Dean Brown, of Dana, who was the second lowest bidder. From his letter to us we make the following extract: "You have made a success of the fishway on Pit River, as I see many salmon in the river. My farm is at the head of Fall River, just below the Big Spring." This fishway was built in the form of a horseshoe. It is cut through solid rock, is 310 feet long, and has an average width of 10 feet. Under normal conditions, it carries about 2,000 inches of water. We point with considerable pride to the fact that after meeting every cent of expense involved in its construction—printing, advertising, traveling expenses for Mr. Shebley and Mr. Vogelsang, and the contract itself—we presented a bill in November, 1902, for $2,058.50, leaving a balance of $941.50, or practically one third of the appropriation, to revert to the general fund of the State.

THE LAUNCH "QUINNAT."

This important and indispensable auxiliary to our bay and river patrol continues to keep up its good record. Without it many of the violators of the fish law would escape detection, as many of the violations occur at night; but our boat, with its noiseless exhaust, has crept up to them and never returned empty-handed. Sometimes the fishermen themselves escape in the darkness, but their fishing gear has fallen into the hands of our deputies. Unless claimed and a fine paid for the violation, the property is condemned under the provisions of Section 636*a* of the Penal Code. In the spring and fall trips for the collection of licenses, the boat covers all the bays, the Sacramento River to a point as far north as Feather River, and the San Joaquin River to the vicinity of Stockton, and has never yet met with an accident nor been laid up for repairs, except the ordinary ones incident to almost continuous service. After seven years' service we have replaced the reversing gear. The twenty-horsepower engine maintains its record for economy in the use of gasoline. The boat is practically as good to-day as when built, which is due largely to the careful and intelligent interest taken by John H. Davis, who has acted as license collector for the past ten years. The vacancy on the boat crew, caused by the resignation of Hugh Walters, was filled by the appointment of A. Soto, who, with Mr. Davis, keeps the boat at all times in perfect condition. When out of commission these deputies are detailed to other duties.



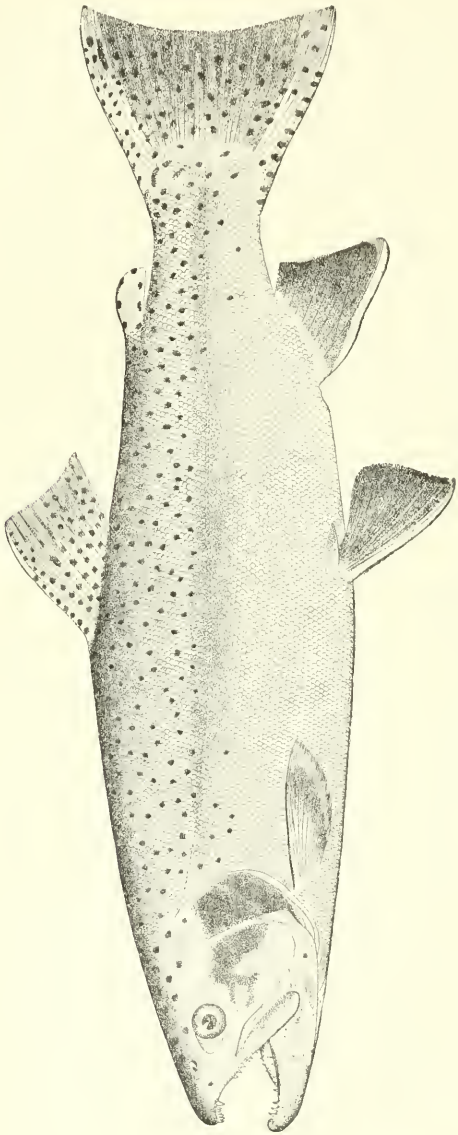
FISH COMMISSION LAUNCH "QUINNAT."

VERDI STATION.

In November of 1902, we began the construction of a new hatchery on Laughton Creek, Sierra County, on lands owned by George H. and W. C. Foulks, of Verdi, Nev., who granted us a free lease for a term of three years. From John W. Hill, who controlled the water rights of Laughton Creek, we received an exclusive privilege, on condition that after passing through our hatchery the water be returned to the main channel. The material for the building was purchased from the Verdi Lumber Company, who made quite a concession on the price of the building material. The construction work was in charge of F. J. Watson, an experienced man from our Sisson hatchery. The general plan was furnished by W. H. Shebley. The building has a capacity of 1,250,000 eggs, and we have also an ample supply of the purest water for that number of eggs. The hatchery was finished and ready to receive eggs on December 12, 1902. The first to be placed in the building were 100,000 Eastern brook-trout eggs received from Leadville, Colo., in February, 1903, which were quickly followed by a large take of Rainbow trout eggs, one third of which were collected at the Essex dam near Verdi, and two thirds at the electric light dam on the Truckee River, two miles above Reno, Nev. Our total collection of Rainbow trout eggs was about 1,200,000—nearly double the number ever before taken in a single season on the Truckee River. This would have been largely increased but for an unexpected freshet, which occurred on March 27, 1903, and overflowed the dams, bringing down logs and other débris, which carried away our traps and other apparatus for capturing and holding the fish. We had on hand at that time a large number of unripe females, which we were obliged to liberate, as the river remained at such a high stage that the male fish were enabled to pass the dams. The operations of spawn-taking were in charge of E. W. Hunt, who had been transferred from Sisson for that purpose. He was assisted by J. P. Morrill of Verdi (an experienced man) and Samuel O'Haver of Reno. Of the total number of eggs collected, fifteen per cent were hatched and delivered to the authorities of Washoe County, Nevada, in consideration of the privilege of operating in that State. About forty-five per cent were hatched and liberated in the Tahoe basin and Truckee region. The remainder were divided between the Sisson hatchery in Siskiyou County and the Wawona hatchery in Yosemite National Park. This splendid take of eggs fully justified the moderate expense of constructing a new station.

The take in the spring of 1904 was most discouraging, although the prospects were flattering. There were large numbers of good-sized fish to be seen, but the heavy and continuous storms kept the Truckee River at a flood stage for several months. The gates at the outlet of Lake

Tahoe, which had been closed during the summer of 1903, had stored the water to a higher level than usual. This was quickly raised by the heavy rain and melting snow until it became necessary, in order to save



RAINBOW TROUT, ADULT MALE—*Salmo irideus.*

the property around Lake Tahoe, to open the floodgates to their full extent. Even with this large outlet, the high-water mark of the famous flood year, 1862, was passed. This continuous flow of such large volume

carried away dams and swept a great deal of heavy débris down the river, which took out our racks and traps and rendered it impossible to replace them. Our total take of Rainbow trout eggs was about 75,000, 35,000 of which, after being eyed, were shipped to the United States Fisheries station at Leadville, Colo., in partial exchange for courtesies that had been extended to us. These eggs were eyed at the small station owned and controlled by J. P. Morrill of Verdi, who was one of the assistants engaged in this work. About 30,000 fry were hatched at this same point and liberated in the waters of the State of Nevada. The work was again in charge of E. W. Hunt, assisted by Mr. Morrill and Harry Warr. The failure to make a good collection was due solely to the unusual conditions. Our men were conscientious and faithful in their work and were disappointed at the season's operations.

We still have another season in which to operate at this station. We have no doubt, now that such an amicable understanding exists between the authorities of Nevada and this State, that an extension of time could be secured if circumstances should warrant it. We hope, however, that our stock of breeders at Sisson will, by the end of another year, furnish an ample supply of young fish for the needs of our State. It is the opinion of many fish culturists that new blood should be introduced among the pond fish at intervals. For that purpose we can easily secure, at any season, 100,000 eggs or more on the Klamath River or one of its tributaries, the Little Shasta at Montague or Shovel Creek at Beswick—points easily accessible from Sisson.

TAHOE AND TALLAC HATCHERIES.

These two stations continue to furnish an unfailing supply of Cutthroat trout eggs. The mouth of Taylor Creek near Tallac continues to be our principal spawn-taking station. From eggs collected at that point we have filled both the Tahoe and Tallac hatcheries and have sent the usual quota, about 200,000 each year, to the Wawona station. The number taken beyond the capacity of these stations was divided between the Sisson, Wawona, and Ukiah hatcheries (the latter being operated by the California Northwestern Railway Company), and from the latter have been taken steelhead fry in exchange, some of which were placed in ponds at Sisson, where their development is being carefully noted. A shipment of 50,000 steelhead fry was sent to the Tahoe region and divided between Fallen Leaf Lake and Granite Lake. For a number of years A. V. La Motte has planted steelhead fry in Clear Lake, Lake County, from the Ukiah hatchery. It was frequently claimed that as they were never heard of, it was a waste of time and money to continue planting them in that lake; besides, the lake had a better fish in the landlocked salmon, which was attaining a weight of

from five to nine pounds and was distinguished for its fighting qualities. Specimens of these "landlocked" salmon were sent to Dr. David Starr Jordan, of Stanford University, who immediately pronounced them steelhead, which confirms the good judgment of Mr. La Motte and establishes the fact that it is not necessary for the steelhead to go to salt water. Judging from the success that has followed our experiments with steelhead fry at Sisson and from the fact that these fish are now being caught in the Great Lakes, we have every reason to anticipate splendid results from the plants made in the Tahoe region and shall be glad to continue our efforts in that direction.

We have been able to materially improve the hatchery buildings and grounds at the Tahoe station. We have enclosed the grounds with a substantial and attractive picket fence; a new foundation has been placed under the hatchery; the old "shake" roof has been replaced with a good shingled roof; the interior of the building has been ceiled throughout and neatly painted, and sleeping quarters for the men were constructed in the loft of the building. The usual repairs were made at the Tallac station, although the extreme high water of the past season has damaged the foundation of the superintendent's cottage at the mouth of Taylor Creek. With this work overhauled, which will be done as soon as the water permits, both our stations on Lake Tahoe will be in the best possible condition.

The general supervision of the egg-collecting, hatching, rearing, and distribution of the fry has been under the direction of E. W. Hunt, an experienced fish culturist. He was assisted at the Tallac station in 1903 by W. B. Hunt and in 1904 by F. F. Anderson.

We are glad to report the strict observance of the ordinances of El Dorado and Placer counties which prohibit the taking of fish in the Tahoe region until June 1st. This close season gives thousands of spawn-bearing fish an opportunity to deposit their eggs and permits us to secure all that we need. Lake Tahoe is just beginning to recover from the continuous drain to which it was subjected for many years in the taking of spawn-bearing fish, beginning on the 1st of April of each year. In that high altitude and low temperature the fish do not mature before the 1st of May and spawning continues up to the 15th of June. It has been frequently charged by market fishermen and others that the scarcity of fish was due to our operations; that we destroyed many fish; that artificial propagation was not a success, and that the county ordinances should be repealed. That artificial propagation is a failure is a statement so wild that it is not considered worthy of argument. Our total take of spawn fish does not exceed 4,000. If ten per cent died through the operations of artificial spawning, which is a liberal allowance, there would still be 3,500 fish returned to the water in as good condition as they ever were, for food or for sport. If the

entire 4,000 were destroyed by our operations, it would be but a small fraction of the millions of Cutthroat trout that inhabit Lake Tahoe.

The following figures are furnished us by Professor Juday, of the State University, who had been sent by the Federal Government to study certain problems regarding the supply of food fish in the Tahoe region. The figures were taken from the books of Wells, Fargo & Co. at Tallac and Tahoe City, and represent the actual number of fish shipped out in 1903, aggregating 12,261 pounds, or upward of six tons of trout shipped during the months of June, July, August, and September. This does not take into account the enormous quantity consumed at the different resorts and by the thousands of campers who visit the Tahoe region each summer. The amount shipped in June, 1904 (one month), exceeds 7,000 pounds, or three and a half tons of trout, which indicates a decided gain over previous years. We consider the foregoing statement a sufficient answer to any criticisms of the value of our work in the Tahoe region.

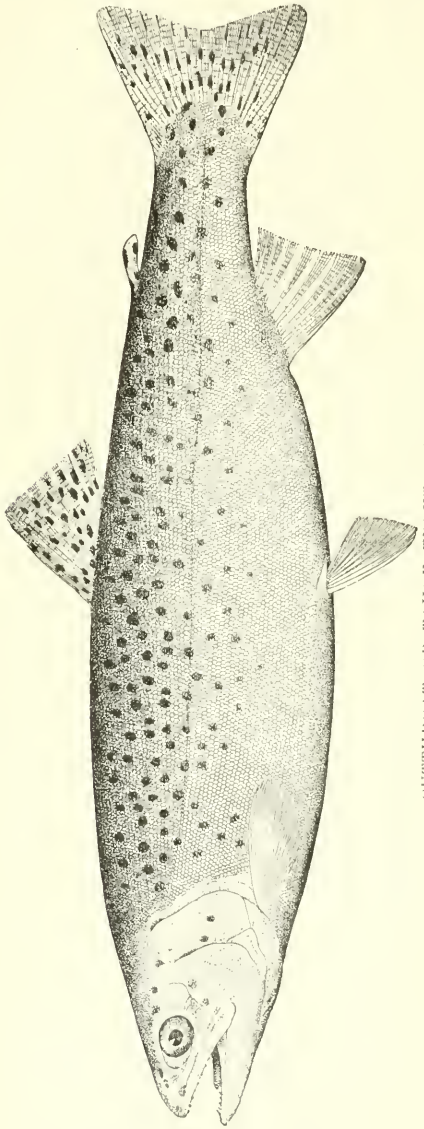
We are indebted to Messrs. Comstock and Lawrence of Tallac and D. L. Bliss & Sons of Tahoe, also to Mrs. George W. Pierce of Glen Alpine Springs, for substantial assistance. We have had free transportation for our employés and the free use of teams and pack animals for distributing the young fish.

We are pleased to commend again the tireless efforts of Prof. W. W. Price of Alta. His work has been so skillfully and intelligently done and his achievements so marked, that we feel that the value of his work should be known to all our people. Each season he has made the Tahoe region the vacation grounds for the young men and boys of his school, and they have contributed their services and time to stocking barren lakes, carrying fish on pack animals or by hand to waters otherwise inaccessible. In that region there are upward of forty lakes, ranging in area from a few acres up to two hundred. Professor Price has stocked eighteen lakes this season, seven of them for the first time this year.

Through the joint efforts of Mrs. Pierce and Professor Price, a small hatchery has been completed at Glen Alpine, with a capacity of 1,000,000 eggs. It will be in operation for the first time next season, and we have no doubt the results will justify the time and expense that have been given and will result in making that region one of the best fishing grounds in the State.

For the past two seasons we have, for the first time, been able to maintain a patrol throughout the summer months on each side of Lake Tahoe and the streams tributary thereto, and have largely checked the depredations of the Nevada Indians. James Stout was the mounted patrol on the Tallac side during 1903. Harry Warr succeeded him in 1904. William Boyle has patroled the country from Tahoe City north

and south, and the Truckee River to the town of Truckee, for the two seasons. These deputies have been conscientious and faithful in the discharge of their duties. Mr. Warr, in addition to taking care of the



CUTTHROAT, OR TAHOE, TROUT—*Salmo henshawi.*

southern end of the lake, has covered a large portion of El Dorado, Alpine, and Amador counties. We believe less violations of the game laws have occurred this year than ever before.

In addition to the Cutthroat trout fry liberated in the Tahoe region,

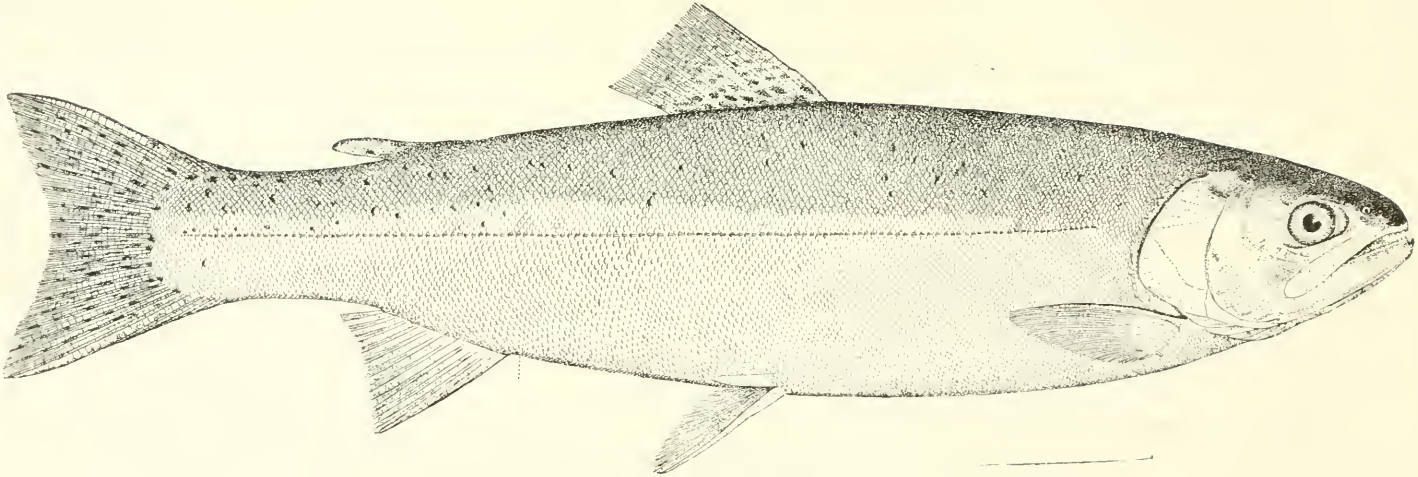
we have shipped upward of 200,000 Eastern brook-trout fry and placed them in various streams and small lakes in that vicinity. The wonderful results that have attended these fish have already been alluded to.

The complete distribution of eggs and fish from the Tallac and Tahoe stations during 1903 and 1904 is summarized in the following table:

Station and Year.	Eastern Brook.	Cutthroat.		Rainbow.
	Fry.	Fry.	Eggs.	Fry.
Tahoe Station.				
1903	10,000	900,000		85,000
1904	50,000	810,000		
Totals	60,000	1,710,000		85,000
Tallac Station.				
1903	35,000	900,700	3,350,000	23,250
1904	125,000	708,000	2,450,000	
Totals	160,000	1,608,700	5,800,000	23,250

EEL RIVER STATION, AND STEELHEAD PROPAGATION.

During the Legislature of 1901, the sum of $2,000 was appropriated to be expended in the work of steelhead propagation in Humboldt County. This money became available after January 1, 1902. In the spring of 1902 we liberated a fraction over 300,000 steelhead fry. We had hoped to increase the number in 1903 by establishing a new egg-collecting station on Howe Creek, to be operated in conjunction with the one on Price Creek. Untimely freshets, coming at the time our traps were in operation, twice carried away our racks on Howe Creek; the last time the water continued at such a stage that it was impossible to replace the traps, and our total take of eggs was therefore about one half that of the preceding year. We liberated about 120,000 young steelhead in Price Creek and Eel River. On March 20, 1904, we again attempted to collect steelhead eggs. In addition to the traps operated on Howe and Price creeks, we engaged the services of a crew of fishermen to operate a seine in Eel River. Our work was again interfered with by the high waters, and it was disappointing in the extreme to see schools of these fish passing up the river and creek at a time when we were utterly unable, owing to the volume and velocity of the water, to capture them and bring our take of steelhead eggs up to what we had expected. While we took quite a number of fish, they were late spawners; in fact, so green that they could not be retained with safety in live cars, so we were obliged to liberate them. We secured only 104,000 eggs, from which about 90,000 strong, healthy fry were liberated. These small plants have, however, materially improved the steelhead



STEELHEAD TROUT—*Salmo gairdneri.*

fishing in Eel River. At a normal stage of water, we could easily capture enough fish to take 2,000,000 eggs.

Of the original appropriation of $2,000 there remains an unexpended balance of $625, which is sufficient to conduct our operations for another season. We consider the financial showing noteworthy, as we have been expending the modest sum of $625 per annum to carry on this work, which is extremely small when taking into consideration the unlooked-for expense caused by high water, which necessitated the replacing of traps, racks, and dams, besides paying for the services of the force engaged in operating the seine. The economical handling of this work and the results obtained under the peculiar disadvantages reflect credit upon the superintendent of the station, W. O. Fassett.

In December, 1902, two shipments of salmon eggs, aggregating 2,190,000, were received from Battle Creek station in Shasta County and from Mill Creek station in Tehama County. These shipments produced about 2,000,000 salmon fry that were successfully liberated in Price Creek and Eel River.

Beginning November 28, 1903, shipments of salmon eggs aggregating 5,520,000, coming from Battle Creek and Mill Creek stations, were received at the Price Creek hatchery, from which we were able to liberate 5,257,000 swimming salmon fry, which we consider a creditable showing.

We are pleased to say that our work is receiving the unanimous indorsement and support of the press and people of Humboldt County. Consequently violations of the fish laws are comparatively rare. Increased runs of both steelhead and salmon have brought forth most favorable comment and recognition of our work. The work of patroling the principal fish streams and other waters of Humboldt County has been faithfully carried out during the last two years by W. P. Huestis, who combines the work of patroling with that of collecting fishermen's licenses. Mr. Huestis has also rendered excellent service in apprehending violators of the game laws, in which work he has been assisted by J. E. Morton, game warden of Humboldt County. As opportunity offered, we have sent other deputies of this Board through portions of Humboldt County and into Trinity, but the bulk of the work has fallen upon Mr. Huestis and has been creditably performed.

The following table gives a summary of distribution of fish from Price Creek station, for the years 1902, 1903, and 1904:

Year.	Salmon.	Steelhead.
1902	2,069,500	----------
1903	5,257,947	120,000
1904	----------	90,000
Totals	7,327,447	211,000

WAWONA HATCHERY.

The hatchery located in the Yosemite National Park at Wawona has been operated during the past two years in the spring and early summer months, under the management of M. L. Cross, one of our most reliable and conscientious employés. The eggs hatched at this station were of the Rainbow and Cutthroat trout varieties. The Rainbow eggs were shipped from the Sisson hatchery and the Cutthroat eggs from Lake Tahoe. While good results have always followed our work in that region, the past two years seem to have been better than any others and a great many fine, healthy fry have been planted in the lakes and streams of the Yosemite region. In 1903 a shipment of 20,000 Eastern brook-trout fry (*Salmo fontinalis*) was sent into the Yosemite region in charge of M. L. Cross, who placed them in suitable waters near Wawona. In 1904 another shipment of 50,000 of these beautiful and gamy fish was sent to Wawona in charge of John H. Davis. About two thirds of the shipment were placed in the upper reaches of the Merced River in the vicinity of the Sentinel Hotel. The remainder were placed in suitable lakes in the vicinity of Wawona. This is the first large plant ever made in the Merced River in Yosemite Valley proper. We look forward with confidence to great results from these fish in those waters.

The following table is a summary of the distribution from the Wawona hatchery in 1903 and 1904:

Year.	Eastern Brook Fry.	Rainbow Fry.	Cutthroat Fry.
1903	20,000	175,000	200,000
1904	50,000		190,000
Totals	70,000	175,000	390,000

To the owners of this hatchery, Messrs. Washburn Brothers, we are indebted for substantial assistance in furnishing free transportation for our employés and deputies, both in and out of the valley, and for the free use of teams and horses for distributing the fry throughout that entire region. They have also furnished free transportation and ice for the hauling in of the Eastern brook-trout from Raymond to Wawona, a distance of 65 miles. As our work is carried on during the busy summer months, when practically all conveyances, animals, and men under their direction are in active service, the value of their assistance can not be overestimated. The work of distribution has been greatly facilitated by officers of the Regular Army, who have been detailed with troops of cavalry to maintain a patrol throughout the park. They have given us the free use of pack animals and men to carry fish over mountain trails to points otherwise inaccessible, besides the use of teams.

To Lieut.-Col. Joseph Garrard, U. S. A., and the men of his command, we are under obligations for valuable services rendered in the summer of 1903, and to Maj. John P. Bigelow Jr., U. S. A., for similar services in 1904. In addition to assisting us in the distribution of the fry, they have assisted materially in the enforcement of the game laws of the State.

During the past two years, the mountain streams of Madera County have been stocked from this hatchery. During the summer of 1903 this work was done under the direction of the county game warden, S. F. Oyler. In the summer of 1904 the work was in charge of Kenneth L. Hughes, specially appointed by the Board of Supervisors of Madera County. Mr. Hughes also made a most successful plant of black bass in Crane Valley Lake.

SONG AND INSECTIVOROUS BIRDS.

We would most urgently recommend the passage of a bill at the coming session of the Legislature to protect all song and insectivorous birds. While no doubt there will be more or less opposition to such a measure, owing to a misunderstanding of the value of birds to the horticulturist, we believe that California, a State in which the horticultural interests are so large and so varied, should take a step forward and protect all song and insectivorous birds, none of which do material damage, when compared to the actual good they do. It has been truly said that they are the best friends of the farmer. They destroy myriads of injurious insects, such as caterpillars, bugs, flies, moths, and their larvæ. Statistics gathered by the United States authorities at Washington from this and other States of the Union show conclusively the wisdom of giving them protection. For example, 238 stomachs of meadowlarks taken throughout the year contained 73 per cent of insects and only 14 per cent of grain. It is further shown that the useful birds comprise 95 per cent of the feathered denizens of field and woodland.

But the number of birds destroyed by farmers, who erroneously believe that such birds are working an injury to them, is small compared to the thousands that are slaughtered by the foreign element in our State, to whom everything is game that has feathers. In addition to their great value as insect-destroyers, they are a most attractive feature in every field and woodland. Unless some action is taken for the protection and preservation of our songsters and other useful birds, this State will soon be rendered as unattractive, by reason of their absence, as certain parts of Europe, where bird life has been practically exterminated.

PERMITS FOR LIVE GAME.

Two years more of experience with the law in regard to the trapping, shipping, and possession of live game, show that the action of the Legislature in vesting this authority absolutely in the Board of Fish Commissioners was a wise move, as it has brought all sections of the State more closely in touch with our office, in other words, with headquarters, and we have been able to keep a close record of permits. The law is being understood and respected. Many requests are declined. We restrict the issuance of permits to trap to the open season when game may be lawfully killed, the exceptions to this rule being when some large institution, which is open and free to the public, desires specimens for scientific purposes. So long as the general public is granted only a limited number of birds, which is seldom more than a half dozen, and is permitted to take them only during the open season and the permit granted when we are satisfied that the birds will be properly cared for, we feel that more good than harm can come from it. As people become more familiar with the various forms of bird life, they become less desirous of destroying or killing them, and it results often in an increase of birds. As in many places throughout the State the increase from these captive birds has been liberated, and as shooting is not allowed on the premises, the birds soon feel safe and make it a permanent home, where they have an opportunity to further increase and spread into other sections.

Some criticism has been heard because permits are issued by this Board to transport live birds from this State. We beg to say that the number is exceedingly small. There are not more than three hundred quail per annum, coming from all parts of the State, that are transported outside of it. The requests come mainly from States that desire to try the experiment of introducing California quail.

As no birds are trapped or transported without permission from this office, and an absolute record is kept of each individual who secures a permit to trap, ship, or possess, we feel there is no just ground for complaint, or any necessity for a change in the present law. All live game that is to be transported from any point inside of this State must be offered to the Wells-Fargo Express Company. This corporation has issued strict orders to all of its agents, and these orders are carefully observed. Live game has been offered at stations unaccompanied by permits, but it is invariably refused transportation until communication is had with the office.

On the suggestion of the Federal department having charge of game preservation at Washington, D. C., we have followed a liberal interpretation of the present law, as that department believed it would be of

mutual advantage to the different sections of the country to make liberal exchanges. We therefore recommend that this law should not be changed.

IMPORTATION OF GAME BIRDS.

Our means have at no time permitted us to take up seriously the introduction of any new species. The Mongolian pheasants that were introduced a number of years ago show a slight increase in certain favored sections of the State, particularly in Santa Clara County, due, in our opinion, to the splendid sentiment that exists among the people of that county to protect and preserve their game, and to enforce the laws. Favorable reports come from Fresno, Humboldt, Santa Cruz, and Kern counties. A number of our citizens have become interested in the subject and are raising birds in captivity, liberating the surplus and distributing others among their neighbors. A great many permits have been issued in the past two years for the transportation of these birds in pairs or trios to different sections of the State, to be used as breeders.

Efforts were again made to secure pheasants direct from China, but we learned that the steamers plying between the principal Asiatic ports and those of Europe have made the pheasant an important item on their bills of fare, which has largely increased the demand, with the result that they are not found in any numbers except at points remote from the seaboard. This has increased their cost to such an extent that they are quite beyond our means.

We believe that the bobwhite quail of the East, if properly placed, would adapt themselves to the conditions of this State. This work has never been undertaken by the State Board, but small shipments were secured by private individuals, though not in sufficient numbers, in our opinion, to make a fair test. We have been in correspondence for some time with the principal breeders in the East, and have been offering an even exchange for valley quail. Charles Payne, of Wichita, Kan., who is most successful in handling these birds, and who has perhaps shipped a larger number than any one else in the United States, quotes us his price at $10 per dozen. We are expecting this fall to secure a number of them in exchange for such valley quail as he may require, paying the difference in cash out of our funds. It is our intention to place these birds in considerable numbers in one or two selected localities, where they would have absolute protection, and from which the ground vermin have been driven or exterminated.

During the summer of 1903, we secured permission, through Dr. T. S. Palmer, Assistant in Charge of Game Preservation, Biological Survey at Washington, D. C., to have transported from Alaska, to this State, fifty pairs of ptarmigan, believing that they would find a suitable habitat

around Mount Shasta and in the Tahoe region. It was represented to us that the birds could be secured without difficulty in the vicinity of Nome. We contracted for fifty pairs at $10 per pair, but not a bird was received. We renewed our efforts in the summer of 1904. We have again secured the necessary permits to trap the birds and have them shipped, at the same figure, and it is hoped that at least a portion of them will arrive.

Early in this year, a deputy of this Board, H. T. Payne, was sent to Mexico to secure specimens of the quail of that country, believing that they would find a congenial breeding-place in our interior valleys. Owing to the continued drought that had prevailed in that country for a number of years, which interfered with the mating and breeding, he was successful only to a limited degree. Mr. Payne brought back with him about four dozen of the *Callipepla elegans*, or Elegant quail, from the State of Sonora, Mexico. These have been placed in localities where they will receive protection and where the conditions are similar to those from which they were taken. It is yet too early to determine the results from this small number, but it is hoped that they will propagate.

A number of Chinese quail that were brought into this State for market purposes were seized by deputies of this Board; arrests followed and the possessors of the birds were convicted and paid substantial fines. Several hundred of these quail were liberated in different parts of the State. They were in evidence for a short time, but seem to have totally disappeared.

In our opinion the bobwhite quail would be a valuable acquisition to our game birds. This variety is well adapted to the stubble fields and river bottoms of our great valleys, differing in that respect from our mountain and valley quail, both of which prefer the mountains and hilly sections. Much has been written and argued about the damage done to grapes and in grain fields by quail, but our observations and experience do not support the contentions.

FISH AND GAME PROTECTIVE ASSOCIATIONS.

In many sections of the State, Fish and Game Protective Associations have been organized during the past few years. They have exerted a wholesome and salutary influence in building up a local sentiment in favor of the fish and game laws, and have in many cases been of great assistance to our regular deputies. These clubs and associations are in the main composed of the most intelligent and loyal people in their respective sections, who understand the value and importance of protecting the fish and game, and the necessity for the restrictions. Many of the associations are in the mountain counties and are

composed of the practical, sensible farmer or workman. In no sense are they preserve clubs. The members usually fish in public waters and hunt in most cases upon the public lands. They are always ready and willing to do their full share of the work of hauling fish to stock the streams in their vicinity, and by their interest and example encourage a more general observance of the law.

To H. T. Payne, one of our regular deputies, has been assigned the work of assisting these organizations in carrying out their aims, which has kept him constantly traveling throughout the length and breadth of the State.

GAME WARDENS.

Many Boards of Supervisors consider the appointment of a game warden a waste of money, a useless expenditure of county funds, and the conclusion is not surprising, considering the service that is often rendered. On the other hand, the proper sort of material for a good officer can not be found for the small salary attached to the office under the provisions of the present County Fish and Game Warden Act.

In our opinion that Act should be amended in several important particulars. First, the compensation should be sufficient to induce good men to seek the office. Second, the Boards of Supervisors should have the right to appoint a warden at any time and for as long a period, not to exceed two years, as in their judgment good services could be rendered. In many counties we believe this would result in men being appointed for shorter terms, with liberal compensation during the seasons of the year such services are most needed. If the fitness of the individual is considered and political influence is made a secondary matter, the chances are largely in favor of finding a competent and faithful officer.

We further believe that the appointment of game wardens should be mandatory and not optional, and if the present restrictions are removed and more discretion vested in the Boards of Supervisors, excellent results would follow.

RECOMMENDATIONS.

The only recommendation calling for an additional appropriation is made in the interest of game, to permit us to increase our force of regular deputies by four. The amount necessary is the modest sum of $5,000 per annum, or $10,000 for two years, which would make a total of $12,500, the same amount that is allowed for the support and maintenance of hatcheries.

We would recommend the following amendments to the game laws:
Amend Section 626*c* by including "any swan or any imported quail."

Amend Section 626*d* by reducing the bag limit on ducks and doves from fifty to twenty-five during any one calendar day.

Amend Section 626*f* by reducing the open season for the taking and killing of male deer to two months, from August 1st to October 1st.

Amend Section 626*g* by making it a misdemeanor to kill a tree squirrel at any time.

Amend Section 626*i* by reducing the number of male deer that can be lawfully killed in one season from three to two.

Amend Section 626*j* so as to prohibit the use of hounds at any time to run, track, or trail any deer.

Amend Section 626*k* by adding thereto "any dove, rail, or any snipe."

Amend Section 626*m* by adding thereto "or animals."

Amend Section 631 by prohibiting the use of any poisonous substances, to take, kill or destroy either the birds "or animals" mentioned.

Amend Section 631*a* by making the minimum penalty for violation of Section 626*e*, $50 instead of $25.

We would recommend the following amendments to the fish laws:

Amend Section 628, relating to black bass, by extending the open season, making it lawful to catch and have black bass in possession from May 15th to December 1st. We would also recommend that the season for the taking of spiny lobster or crawfish be closed for two years.

Amend Section 632 by increasing the weight limit on trout that can be lawfully sold, from one half pound to one pound; by extending the close season from April 1st to May 1st; by placing a bag limit of fifty as the number of trout that can be lawfully taken during one calendar day; by making it an offense to have in possession any trout less than five inches in length, and by prohibiting the taking of steelhead with nets or seines at any time.

ACKNOWLEDGMENTS.

To you officially and personally we desire to express our sincere appreciation of the confidence you have shown in us, and the encouraging interest you have taken in our work. All our requests and recommendations have met with courteous recognition and approval, for which we thank you.

The Commission acknowledges its gratitude to the following railway and transportation companies for the free transportation of all our employés, apparatus, eggs, and fish. Without their assistance our efforts would have been restricted to very narrow limits, and could not have been given for the benefit of the whole State: Southern Pacific Company, Santa Fé System, Sierra Railway Company, California

Northwestern Railway Company, North Pacific Coast Railway Company, Lake Tahoe Railway and Transportation Company, Nevada-California-Oregon Railway Company, Boca and Loyalton Railway Company.

To the Spring Valley Water Company of San Francisco we are indebted for a valuable concession, permitting us the free use of water at the Ferry Building to "set up" our shipments of young fish, which requires a considerable amount of running water for a length of time varying from three to twelve hours.

To A. Christeson, General Manager of Wells, Fargo & Co., J. C. Tice, agent at San Francisco, and all the superintendents, agents, and employés of their company, we are specially indebted for many privileges and most courteous treatment. No reasonable request has failed to receive attention, and in many cases voluntary assistance that was of great value to our work has been freely given the deputies of this Board.

To all employés of the Southern Pacific Company, officials or subordinates, with whom our deputies or officers have come in contact, we are under special obligations for assistance rendered our men when moving fish, eggs, or other material used in our work.

To the various fish and game protective associations, that have been referred to, we are under obligations, not only for assistance rendered our deputies, but for the upbuilding of public sentiment, which is such an important factor in sustaining the fish and game laws.

For substantial assistance in the form of free transportation for all of our men, the eggs and the fry, and for other courtesies, our thanks are extended to D. L. Bliss, Jr., Superintendent of the Lake Tahoe Railway and Transportation Company.

To Messrs. Lawrence and Comstock, of Tallac, we are again indebted for free use of teams for hauling fish, eggs, and supplies, and for many privileges. Without the assistance rendered from these gentlemen at Tahoe and Tallac, respectively, our operations would be seriously handicapped.

During the past two years all the salmon eggs hatched at our stations have been furnished by the United States Bureau of Fish and Fisheries, from Baird on the McCloud River and from their Battle Creek and Mill Creek egg-collecting stations.

Our thanks are extended to Hon. George M. Bowers, United States Commissioner of Fish and Fisheries; also to his able assistants in Washington, Dr. H. M. Smith and John W. Titcomb; also to Capt. G. H. Lambson, Superintendent of Baird Station.

For much valuable information and also for interesting papers on the fishes of the Pacific, we are under obligations to Dr. David Starr Jordan, President of Leland Stanford Junior University.

In submitting this report of the work done in the past two years, permit us to say that we feel satisfied with the record, and believe that it will meet with the approval of yourself and of all fair-minded citizens. We trust the incoming Legislature will give careful consideration to our recommendations, which represent our best judgment, based on our experience and close observation of the various subjects, and which, if enacted into laws, will better enable us to carry out the important reasons for which this Commission was created.

Yours respectfully,

W. W. VAN ARSDALE,
W. E. GERBER,
Fish Commissioners.

San Francisco, Cal., September, 1904.

APPENDIX

TO THE

EIGHTEENTH BIENNIAL REPORT

OF THE

BOARD OF FISH COMMISSIONERS.

1903–1904.

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CRIMINAL LAW—VIOLATION OF FISHING LAW—PENALTY—CONSTRUCTION OF PENAL CODE—JURISDICTION OF SUPERIOR COURT—CASE AFFIRMED. The Superior Court has jurisdiction of a criminal prosecution for the violation of Section 634 of the Penal Code in regard to the possession and sale of fresh salmon between the tenth of September and the sixteenth of October of a specified year. That section fixes no maximum limit of penalty for the offense; and its construction is not affected by Section 19 of the Penal Code. The case of *People* vs. *Tom Nop*, 124 Cal. 150, affirmed and applied.

ID. DEFECT IN INFORMATION—OMISSION OF WORD. The omission of the word "did" before the verbs "have" and "sell" in the information, thereby making these verbs in the wrong tense, is a mere defect in matter of form, not tending to the prejudice of a substantial right of defendant upon the merits, and is not ground for reversal.

ID. DATE OF CATCHING OF FISH—REJECTION OF EVIDENCE—CASE AFFIRMED. Where the charge is to the effect that on the eleventh day of September, being the first day of the prohibited season, the defendant unlawfully had in his possession and sold fresh salmon, it was not error to refuse evidence that the fish were caught prior to that date. The case of *Ex Parte Maier*, 103 Cal. 476 (1), affirmed and applied.

Advance Notes from "A Guide to the Study of Fishes." By courtesy of Henry Holt & Co.

PACIFIC SPECIES OF SALMON AND TROUT.

By DAVID STARR JORDAN, President of Leland Stanford Junior University.

SALMONIDÆ.

The Salmon Family.—The series or suborder *Salmonoidea*, or allies of the salmon and trout, are characterized as a whole by the presence of the adipose fin, a structure also retained in Characius and catfishes, which have no evident affinity with the trout, and in the lantern-fishes, lizard-fishes, and trout-perches, in which the affinity is very remote. Probably these groups all have a common descent from some primitive fish having an adipose fin, or at least a fleshy fold on the back.

Of all the families of fishes, the one most interesting from almost every point of view is that of the *Salmonidæ*, the salmon family. As now restricted, it is not one of the largest families, as it comprises less than a hundred species; but in beauty, activity, gaminess, quality as food, and even in size of individuals, different members of the group stand easily with the first among fishes. The following are the chief external characteristics which are common to the members of the family:

Body oblong or moderately elongate, covered with cycloid scales of varying size. Head naked. Mouth terminal or somewhat inferior, varying considerably among the different species, those having the mouth largest usually having also the strongest teeth. Maxillary provided with a supplemental bone, and forming the lateral margin of the upper jaw. Pseudobranchiæ present. Gill-rakers varying with the species. Opercula complete. No barbels. Dorsal fin of moderate length, placed near the middle of the length of the body. Adipose fin well developed. Caudal fin forked. Anal fin moderate or rather long. Ventral fins nearly median in position. Pectoral fins inserted low. Lateral line present. Outline of belly rounded. Vertebræ in large number, usually about sixty.

The stomach in all the *Salmonidæ* is siphonal, and at the pylorus are many (15 to 200) comparatively large pyloric cæca. The air-bladder is large. The eggs are usually much larger than in fishes generally, and the ovaries are without special duct, the ova falling into

the cavity of the abdomen before exclusion. The large size of the eggs, their lack of adhesiveness, and the readiness with which they may be impregnated, render the *Salmonidæ* peculiarly adapted for artificial culture.

The *Salmonidæ* are peculiar to the North Temperate and Arctic regions, and within this range they are almost equally abundant wherever suitable waters occur. Some of the species, especially the larger ones, are marine and anadromous, living and growing in the sea, and ascending fresh waters to spawn. Still others live in running brooks, entering lakes or the sea when occasion serves, but not habitually doing so. Still others are lake fishes, approaching the shore or entering brooks in the spawning season, at other times retiring to waters of considerable depth. Some of them are active, voracious, and gamy, while others are comparatively defenseless and will not take the hook. They are divisible into ten easily recognized genera: *Coregonus*, *Argyrosomus*, *Plecoglossus*, *Brachymystax*, *Stenodus*, *Oncorhynchus*, *Salmo*, *Hucho*, *Cristivomer*, and *Salvelinus*.

Fragments of fossil trout, very imperfectly known, are recorded chiefly from Pleistocene deposits of Idaho, under the name of *Rhabdofario lacustris*. We have also received from Dr. C. Merriam, from ferruginous sands of the same region, several fragments of jaws of salmon in the hook-nosed condition, with enlarged teeth, showing that the present salmon runs have been in operation for many thousands of years. Most other fragments hitherto referred to *Salmonidæ* belong to some other kind of fish.

Oncorhynchus, the Quinnat Salmon.—The genus *Oncorhynchus* contains the salmon of the Pacific. They are in fact, as well as in name, the king salmon. The genus is closely related to *Salmo*, with which it agrees in general as to the structure of its vomer, and from which it differs in the increased number of anal rays, branchiostegals, pyloric cæca, and gill-rakers. The character most convenient for distinguishing *Oncorhynchus*, young or old, from all the species of *Salmo*, is the number of developed rays in the anal fin. These in *Oncorhynchus* are thirteen to twenty, in *Salmo*, nine to twelve.

The species of *Oncorhynchus* have long been known as anadromous salmon, confined to the North Pacific. The species were first made known nearly one hundred and fifty years ago by that most exact of early observers, Steller, who almost simultaneously with Krascheninnikov, another early investigator, distinguished them with perfect accuracy under their Russian vernacular names. These Russian names were, in 1792, adopted by Walbaum as specific names in giving to these animals a scientific nomenclature. Five species of *Oncorhynchus* are well known on both shores of the North Pacific, besides one other in Japan. These have been greatly misunderstood by early observers

on account of the extraordinary changes due to differences in surroundings, in sex and in age, and in conditions connected with the process of reproduction.

There are five species of salmon (*Oncorhynchus*) in the waters of the North Pacific, all found on both sides, besides one other which is known only from the waters of Japan. These species may be called: (1) the quinnat, or king salmon, (2) the blue-back salmon, or redfish, (3) the silver salmon, (4) the dog salmon, (5) the humpback salmon, and (6) the masu; or (1) *Oncorhynchus tschawytscha*, (2) *Oncorhynchus nerka*, (3) *Oncorhynchus milktschitch*, (4) *Oncorhynchus keta*, (5) *Oncorhynchus gorbuscha*, (6) *Oncorhynchus masou*. All these species save the last are now known to occur in the waters of Kamchatka, as well as in those of Alaska and Oregon. These species, in all their varied conditions, may usually be distinguished by the characters given below. Other differences of form, color, and appearance are absolutely valueless for distinction, unless specimens of the same age, sex, and condition are compared.

The quinnat salmon (*Oncorhynchus tschawytscha*)*, called quinnat, tyee, chinook, or king salmon, has an average weight of 22 pounds, but individuals weighing 70 to 100 pounds are occasionally taken. It has about 16 anal rays, 15 to 19 branchiostegals, 23 (9+14) gill-rakers on the anterior gill-arch, and 140 to 185 pyloric cœca. The scales are comparatively large, there being from 130 to 155 in a longitudinal series. In the spring the body is silvery, the back, dorsal fin, and caudal fin having more or less of round black spots, and the sides of the head having a peculiar tin-colored metallic luster. In the fall the color is often black or dirty red, and the species can then be distinguished from the dog salmon by its larger size and by its technical characters. The flesh is rich and salmon-red, becoming suddenly pale as the spawning season draws near.

The blue-back salmon (*Oncorhynchus nerka*)†, also called red salmon, sukkegh, or sockeye, usually weighs from 5 to 8 pounds. It has about 14 developed anal rays, 14 branchiostegals, and 75 to 95 pyloric cœca. The gill-rakers are more numerous than in any other salmon, the number being usually about 39 (16+23). The scales are larger, there being 130 to 140 in the lateral line. In the spring the form is plumply rounded, and the color is a clear bright blue above, silvery below, and everywhere immaculate. Young fishes often show a few round black spots, which disappear when they enter the sea. Fall

* For valuable accounts of the habits of this species the reader is referred to papers by the late Cloudsley Rutter, ichthyologist of the Albatross, in the publications of the United States Fish Commission, the "Popular Science Monthly," and the "Overland Monthly."

† For valuable records of the natural history of this species the reader is referred to various papers by Dr. Barton Warren Evermann in the bulletins of the United States Fish Commission and elsewhere.

specimens in the lakes are bright crimson in color, the head clear olive-green, and they become in a high degree hook-nosed and slab-sided, and bear little resemblance to the spring run. Young spawning male grilse follow the changes which take place in the adult, although often not more than half a pound in weight. These little fishes often appear in mountain lakes, but whether they are landlocked or have come up from the sea is still unsettled. These dwarf forms, called kokos by the Indians and benimasre in Japan, form the subspecies *Oncorhynchus nerka kennerlyi*. The flesh in this species is firmer than that of any other and very red, of good flavor though drier and less rich than the king salmon.

The silver salmon, or coho (*Oncorhynchus milktschitech* or *kisutch*), reaches a weight of 5 to 8 pounds. It has 13 developed rays in the anal, 13 branchiostegals, 23 (10+13) gill-rakers, and 45 to 80 pyloric cœca. There are about 127 scales in the lateral line. The scales are thin and all except those of the lateral line readily fall off. This feature distinguishes the species readily from the red salmon. In color it is silvery in spring, greenish above, and with a few faint black spots on the upper parts only. In the fall the males are mostly of a dirty red. The flesh in this species is of excellent flavor, but pale in color, and hence less valued than that of the quinnat and the red salmon.

The dog salmon, calico salmon, or chum, called sake in Japan (*Oncorhynchus keta*), reaches an average weight of about 7 to 10 pounds. It has about 14 anal rays, 14 branchiostegals, 24 (9+15) gill-rakers, and 140 to 185 pyloric cœca. There are about 150 scales in the lateral line. In spring it is dirty silvery, immaculate, or sprinkled with small black specks, the fins dusky, the sides with faint traces of gridiron-like bars. In the fall the male is brick-red or blackish, and its jaws are greatly distorted. The pale flesh is well flavored when fresh, but pale mushy in texture and muddy in taste when canned. It is said to take salt well, and great numbers of salt dog salmon are consumed in Japan.

The humpback salmon, or pink salmon (*Oncorhynchus gorbuscha*), is the smallest of the American species, weighing from 3 to 5 pounds. It has usually 15 anal rays, 12 branchiostegals, 28 (13+15) gill-rakers, and about 180 pyloric cœca. Its scales are much smaller than in any other salmon, there being 180 to 240 in the lateral line. In color it is bluish above, silvery below, the posterior and upper parts with many round black spots, the caudal fin always having a few large black spots oblong in form. The males in fall are dirty red, and are more extravagantly distorted than in any other of the *Salmonidæ*. The flesh is softer than in the other species; it is pale in color, and, while of fair flavor when fresh, is distinctly inferior when canned.

The masu, or yezomasu (*Oncorhynchus masou*), is very similar to the humpback, the scales a little larger, the caudal without black spots, the back usually immaculate. It is one of the smaller salmon, and is fairly abundant in the streams of Hokkaido, the island formerly known as Yezo.

Of these species the blue-back or red salmon predominates in Fraser River and in most of the small rivers of Alaska, including all those which flow from lakes. The greatest salmon rivers of the world are the Nushegak and Karluk in Alaska, with the Columbia River, Fraser River, and Sacramento River farther south. The red and the silver salmon predominate in Puget Sound, the quinnat in the Columbia and the Sacramento, and the silver salmon in most of the smaller streams along the coast. All the species occur, however, from the Columbia northward; but the blue-black is not found in the Sacramento. Only the quinnat and the dog salmon have been noticed south of San Francisco. In Japan *keta* is by far the most abundant species of salmon. It is known as sake, and largely salted and sold in the markets. *Nerka* is known only as landlocked in Lake Akan in northern Hokkaido. *Milktschitsch* is generally common, and with *masou* is known as masu, or small salmon, as distinguished from the large salmon, or sake. *Tschawytscha* and *gorbuscha* are unknown in Japan. *Masou* has not been found elsewhere.

The quinnat and blue-back salmon, the "noble salmon," habitually "run" in the spring, the others in the fall. The usual order of running in the rivers is as follows: *tschawytscha*, *nerka*, *milktschitsch*, *gorbuscha*, *keta*. Those which run first go farthest. In the Yukon the quinnat runs as far as Caribou Crossing and Lake Bennett, 2,250 miles. The red salmon runs to "Forty-Mile," which is nearly 1,800 miles. Both ascend to the head of the Columbia, Fraser, and Nass, Skeena, Stikeen, and Taku rivers. The quinnat runs practically only in the streams of large size, fed with melting snows; the red salmon only in streams which pass through lakes. It spawns only in small streams at the head of a lake. The other species spawn in almost any fresh water and only close to the sea.

The economic value of the spring-running salmon is far greater than that of the other species, because they can be captured in numbers when at their best, while the others are usually taken only after deterioration.

The habits of the salmon in the ocean are not easily studied. Quinnat and silver salmon of all sizes are taken with the seine at almost any season in Puget Sound and among the islands of Alaska. This would indicate that these species do not go far from the shore. The silver salmon certainly does not. The quinnat pursues the schools of herring. It takes the hook freely in Monterey Bay, both near the shore

and at a distance of six to eight miles out. We have reason to believe that these two species do not necessarily seek great depths, but probably remain not very far from the mouth of the rivers in which they were spawned. The blue-back or red salmon certainly seeks deeper water, as it is seldom or never taken with the seine along shore, and it is known to enter the Straits of Fuca in July, just before the running season, therefore coming in from the open sea. The great majority of the quinnat salmon, and probably all the blue-back salmon, enter the rivers in the spring. The run of the quinnat begins generally at the last of March; it lasts, with various modifications and interruptions, until the actual spawning season in November, the greatest runs being in early June in Alaska, in July in the Columbia. The run begins earliest in the northernmost rivers, and in the longest streams, the time of running and the proportionate amount in each of the subordinate runs varying with each different river. In general, the runs are slack in the summer and increase with the first high water of autumn. By the last of August only straggling blue-backs can be found in the lower course of any stream; but both in the Columbia and in the Sacramento the quinnat runs in considerable numbers at least till October. In the Sacramento the run is greatest in the fall, and more run in the summer than in spring. In the Sacramento and the smaller rivers southward there is a winter run, beginning in December. The spring quinnat salmon ascends only those rivers which are fed by the melting snows from the mountains and which have sufficient volume to send their waters well out to sea. Those salmon which run in the spring are chiefly adults (supposed to be at least three years old). Their milt and spawn are no more developed than at the same time in others of the same species which have not yet entered the rivers. It would appear that the contact with cold fresh water, when in the ocean, in some way causes them to run toward it, and to run before there is any special influence to that end exerted by the development of the organs of generation. High water on any of these rivers in the spring is always followed by an increased run of salmon. The salmon-canners think—and this is probably true—that salmon which would not have run till later are brought up by the contact with the cold water. The cause of this effect of cold fresh water is not understood. We may call it an instinct of the salmon, which is another way of expressing our ignorance. In general, it seems to be true that in those rivers and during those years when the spring run is greatest the fall run is least to be depended on.

The blue-back salmon runs chiefly in July and early August, beginning in late June in the Chilcoot River, where some were found actually spawning July 15; beginning after the middle of July in the Fraser River.

As the season advances, smaller and younger salmon of these species

(quinnat and blue-back) enter the rivers to spawn, and in the fall these young specimens are very numerous. We have thus far failed to notice any gradations in size or appearance of these young fish by which their ages could be ascertained. It is, however, probable that some of both sexes reproduce at the age of one year. In the Fraser River, in the fall, quinnat male grilse of every size, from eight inches upward, were running, the milt fully developed, but usually not showing the hooked jaws and dark colors of the older males. Females less than eighteen inches in length were not seen. All of either sex, large and small, then in the river had the ovaries or milt developed. Little blue-backs of every size, down to six inches, are also found in the upper Columbia in the fall, with their organs of generation fully developed. Nineteen twentieths of these young fish are males, and some of them have the hooked jaws and red color of the old males. Apparently all these young fishes, like the old ones, die after spawning.

The average weight of the adult quinnat in the Columbia, in the spring, is 22 pounds; in the Sacramento, about 16 pounds. Individuals weighing from 40 to 60 pounds are frequently found in both rivers, and some as high as 80 or even 100 pounds are recorded, especially in Alaska, where the species tends to run larger. It is questionable whether these large fishes are those which, of the same age, have grown more rapidly; those which are older, but have for some reason failed to spawn; or those which have survived one or more spawning seasons. All these origins may be possible in individual cases. There is, however, no positive evidence that any salmon of the Pacific survives the spawning season.

Those fish which enter the rivers in the spring continue their ascent until death or the spawning season overtakes them. Doubtless not one of them ever returns to the ocean, and a large proportion fail to spawn. They are known to ascend the Sacramento to its extreme headwaters, about four hundred miles. In the Columbia they ascend as far as the Bitter Root and Sawtooth mountains of Idaho, and their extreme limit is not known. This is a distance of nearly a thousand miles. In the Yukon a few ascend to Caribou Crossing and Lake Bennett, 2,250 miles. At these great distances, when the fish have reached the spawning grounds, besides the usually changes of the breeding season their bodies are covered with bruises, on which patches of white fungus (*Saprolegnia*) develop. The fins become mutilated, their eyes are often injured or destroyed, parasitic worms gather in their gills, they become extremely emaciated, their flesh becomes white from the loss of oil; and as soon as the spawning act is accomplished, and sometimes before, *all* of them die. The ascent of the Cascades and the Dalles of the Columbia causes the injury or death of a great many salmon.

When the salmon enter the river they refuse to take bait, and their

stomachs are always found empty and contracted. In the rivers they do not feed; and when they reach the spawning grounds their stomachs, pyloric cæca and all, are said to be no larger than one's finger. They will sometimes take the fly, or a hook baited with salmon-roe, in the clear waters of the upper tributaries, but this is apparently solely out of annoyance, snapping at the meddling line. Only the quinnat and blue-back (there called red fish) have been found at any great distance from the sea, and these (as adult fishes) only in late summer and fall.

The spawning season is probably about the same for all the species. It varies for each of the different rivers, and for different parts of the same river. It doubtless extends from July to December, and takes place usually as soon as the temperature of the water falls to 54°. The manner of spawning is probably similar for all the species. In the quinnat the fishes pair off; the male, with tail and snout, excavates a broad, shallow "nest" in the gravelly bed of the stream, in rapid water, at a depth of one to four feet, and the female deposits her eggs in it. They then float down the stream tail foremost, the only fashion in which salmon descend to the sea. As already stated, in the head-waters of the large streams, unquestionably, all die; it is the belief of the writer that none ever survive. The young hatch in sixty days, and most of them return to the ocean during the high water of the spring. They enter the river as adults at the age of about four years.

The salmon of all kinds in the spring are silvery, spotted or not according to the species, and with the mouth about equally symmetrical in both sexes. As the spawning season approaches the female loses her silvery color, becomes more slimy, the scales on the back partly sink into the skin, and the flesh changes from salmon-red and becomes variously paler, from the loss of oil; the degree of paleness varying much with individuals and with inhabitants of different rivers. In the Sacramento the flesh of the quinnat, in either spring or fall, is rarely pale. In the Columbia a few with pale flesh are sometimes taken in spring, and an increasing number from July on. In the Fraser River the fall run of the quinnat is nearly worthless for canning purposes, because so many are "white-meated." In the spring very few are "white-meated"; but the number increases toward fall, when there is every variation, some having red streaks running through them, others being red toward the head and pale toward the tail. The red and pale ones can not be distinguished externally, and the color is dependent on neither age nor sex. There is said to be no difference in the taste, but there is little market for canned salmon not of the conventional orange-color.

As the season advances the difference between the males and females becomes more and more marked, and keeps pace with the development of the milt, as is shown by dissection. The males have (1) the pre-

maxillaries and the tip of the lower jaw more and more prolonged, both of the jaws becoming finally strongly and often extravagantly hooked, so that either they shut by the side of each other like shears, or else the mouth can not be closed. (2) The front teeth become very long and canine-like, their growth proceeding very rapidly, until they are often half an inch long. (3) The teeth on the vomer and tongue often disappear. (4) The body grows more compressed and deeper at the shoulders, so that a very distinct hump is formed; this is more developed in the humpback salmon, but is found in all. (5) The scales disappear, especially on the back, by the growth of spongy skin. (6) The color changes from silvery to various shades of black and red, or blotchy, according to the species. The blue-back turns rosy-red, the head bright olive; the dog salmon a dull red with blackish bars, and the quinnat generally blackish. The distorted males are commonly considered worthless, rejected by the canners and salmon-salters, but preserved by the Indians. These changes are due solely to influences connected with the growth of the reproductive organs. They are not in any way due to the action of fresh water. They take place at about the same time in the adult males of all species, whether in the ocean or in the rivers. At the time of the spring runs all are symmetrical. In the fall all males, of whatever species, are more or less distorted. Among the dog salmon, which run only in the fall, the males are hook-jawed and red-blotched when they first enter the Straits of Fuca from the outside. The humpback, taken in salt water about Seattle, have the same peculiarities. The male is slab-sided, hook-billed, and distorted, and is rejected by the canners. No hook-jawed females of any species have been seen.

On first entering a stream the salmon swim about as if playing. They always head toward the current, and this appearance of playing may be simply due to facing the moving tide. Afterwards they enter the deepest parts of the stream and swim straight up, with few interruptions. Their rate of travel at Sacramento is estimated by Stone at about two miles per day; on the Columbia, at about three miles per day. Those which enter the Columbia in the spring and ascend to the mountain rivers of Idaho must go at a more rapid rate than this, as they must make an average of nearly four miles per day.

As already stated, the economic value of any species depends in great part on its being a "spring salmon." It is not generally possible to capture salmon of any species in large numbers until they have entered the estuaries or rivers, and the spring salmon entered the large rivers long before the growth of the organs of reproduction has reduced the richness of the flesh. The fall salmon can not be taken in quantity until their flesh has deteriorated; hence the dog salmon is practically almost worthless except to the Indians, and the humpback salmon was

regarded as little better until comparatively recently, when it has been placed on the market in cans as "Pink Salmon." It sells for about half the price of the red salmon and one third that of the quinnat. The red salmon is smaller than the quinnat but, outside the Sacramento and the Columbia, far more abundant, and at present it exceeds the quinnat in economic value. The pack of red salmon in Alaska amounted in 1902 to over two million cases (48 pounds each), worth wholesale about $4.00 per case, or about $8,000,000. The other species in Alaska yield about one million cases, the total wholesale value of the pack for 1902 being $8,667,673. The aggregate value of the quinnat is considerably less, but either species far exceed in value all other fishes of the Pacific taken together. The silver salmon is found in the inland waters of Puget Sound for a considerable time before the fall rains cause the fall runs, and it may be taken in large numbers with seines before the season for entering the rivers.

The fall salmon of all species, but especially of the dog salmon, ascend streams but a short distance before spawning. They seem to be in great anxiety to find fresh water, and many of them work their way up little brooks only a few inches deep, where they perish miserably, floundering about on the stones. Every stream, of whatever kind, from San Francisco to Bering Sea, has more or less of these fall salmon.

The absence of the fine spring salmon in the streams of Japan is the cause of the relative unimportance of the river fisheries of the northern island of Japan, Hokkaido. It is not likely that either the quinnat or the red salmon can be introduced into these rivers, as they have no snow-fed streams, and few of them pass through lakes which are not shut off by waterfalls. For the same reason neither of these species is likely to become naturalized in the waters of our Eastern States, though it is worth while to bring the red salmon to the St. Lawrence. The silver salmon, already abundant in Japan, should thrive in the waters and bays of New England.

Salmon-Packing.—The canning of salmon, that is, the packing of the flesh in tin cases, hermetically sealed after boiling, was begun on the Columbia River by the Hume Brothers in 1866. In 1874 canneries were established on the Sacramento River, in 1876 on Puget Sound and on Fraser River, and in 1878 in Alaska. At first only the quinnat salmon was packed; afterwards the red salmon and the silver salmon, and finally the humpback, known commercially as pink salmon. In most cases the flesh is packed in one-pound tins, forty-eight of which constitute a case. The wholesale price in 1903 was for quinnat salmon $5.60 per case, red salmon $4.00, silver salmon $2.60, humpback salmon $2.00, and dog salmon $1.50. It costs in round numbers $2.00 to pack a case of salmon. The very low price of the inferior brands is due to overproduction.

The output of the salmon fishery of the Pacific Coast amounts to about fifteen millions per year, that of Alaska constituting seven or nine millions of this amount. Of this amount the red salmon constitutes somewhat more than half, the quinnat about four fifths of the rest.

In almost all salmon streams there is evidence of considerable diminution in numbers, although the evidence is sometimes conflicting. In Alaska this has been due to the vicious custom, now done away with, of barricading the streams so that the fish could not reach the spawning grounds, but might be all taken with the net. In the Columbia River the reduction in numbers is mainly due to stationary traps and salmon-wheels, which leave the first relatively little chance to reach the spawning grounds. In years of high water doubtless many salmon run in the spring which might have otherwise waited until fall.

The key to the situation lies in the artificial propagation of salmon by means of well-ordered hatcheries. By this means the fisheries of the Sacramento have been fully restored, those of the Columbia approximately maintained, and a hopeful beginning has been made in hatching red salmon in Alaska.

SALMO, THE TROUT, AND ATLANTIC SALMON.

The genus *Salmo* comprises those forms of salmon which have been longest known. As in related genera, the mouth is large, and the jaws, palatines, and tongue are armed with strong teeth. The vomer is flat, its shaft not depressed below the level of the head or chevron (the anterior end). There are a few teeth on the chevron; and behind it, on the shaft, there is either a double series of teeth or an irregular single series. These teeth in the true salmon disappear with age, but in the others (the black-spotted trout) they are persistent. The scales are silvery and moderate or small in size. There are 9 to 11 developed rays in the anal fin. The caudal fin is truncate, or variously concave or forked. There are usually 40 to 70 pyloric cœca, 11 or 12 branchiostegals, and about 20 (8+12) gill-rakers. The sexual peculiarities are in general less marked than in *Oncorhynchus;* they are also greater in the anadromous species than in those which inhabit fresh waters. In general, the male in the breeding season is redder, its jaws are prolonged, the front teeth enlarged, the lower jaw turned upward at the end, and the upper jaw notched, or sometimes even perforated, by the tip of the lower. All the species of *Salmo* (like those of *Oncorhynchus*) are more or less spotted with black. Unlike the species of *Oncorhynchus*, the species of *Salmo* feed more or less while in fresh water, and the individuals for the most part do not die after spawning, although many old males do thus perish.

The black-spotted trout, forming the subgenus *Salar*, differ from *Salmo salar* and *Salmo trutta* in the greater development of the vomerine teeth, which are persistent throughout life, in a long double series on the shaft of the vomer. About seven species are laboriously distinguished by Dr. Guenther in the waters of western Europe. Most of these are regarded by Dr. Day as varieties of *Salmo fario*. The latter species, the common river-trout or lake-trout of Europe, is found throughout northern and central Europe, wherever suitable waters occur. It is abundant, gamy, takes the hook readily, and is excellent as food. It is more hardy than the different species of charr, although from an æsthetic point of view it must be regarded as inferior to all of the *Salvelini*. The largest river-trout recorded by Dr. Day weighed twenty-one pounds. Such large individuals are usually found in lakes in the north, well stocked with smaller fishes on which trout may feed. Farther south, where the surroundings are less favorable to trout life, they become mature at a length of less than a foot, and a weight of a few ounces. These excessive variations in the size of individuals have received too little notice from students of *Salmonida*. Similar varieties occur in all the non-migratory species of *Salmo* and of *Salvelinus*. Numerous river-trout have been recorded from northern Asia, but as yet nothing can be definitely stated as to the number of species actually existing.

In North America only the region west of the Mississippi Valley, the streams of southeastern Alaska, and the valley of the Mackenzie River have species of black-spotted trout. There are few of these north of Sitka in Alaska, although black-spotted trout are occasionally taken on Kadiak and about Bristol Bay, and none east of the Rocky Mountain region. If we are to follow the usage of the names "salmon" and "trout" which prevails in England, we should say that, in America, it is only these western regions which have any trout at all. Of the number of species (about twenty-five in all) which have been indicated by authors, certainly not more than about eight to ten can possibly be regarded as distinct species. The other names are either useless synonyms, or else they have been applied to local varieties which pass by degrees into the ordinary types.

In the western part of America are found more than a score of trout of the genus *Salmo*, all closely related and difficult to distinguish. There are representatives in the headwaters of the Rio Grande, Arkansas, South Platte, Missouri, and Colorado rivers; also in the Great Salt Lake basin, throughout the Columbia basin, and in all suitable waters from southern California and Chihuahua to Sitka, and even to Bristol Bay, similar forms again appearing in Kamchatka and Japan.

Among the various more or less tangible species that may be recognized, three distinct series appear. These have been termed the cut-

throat-trout series (allies of *Salmo clarkii*), the rainbow-trout series (allies of *Salmo irideus*), and the steelhead series (allies of *Salmo gairdneri*).

The steelhead, or *gairdneri*, series is found in the coastwise streams of California and in the streams of Oregon and Washington, below the great Shoshone Falls of Snake River, and northward in Alaska along the mainland as far as Skagway. The steelhead trout reaches a large size (10 to 20 pounds). They spend a large part of their life in the sea. In all the true steelheads the head is relatively very short, its length being contained about five times in the distance from tip of snout to base of caudal fin. The scales in the steelhead are always rather small, about 150 in a linear series, and there is no red under the throat. The spots on the dorsal fin are fewer in the steelhead (4 to 6 rows) than in the other American trout.

The rainbow forms are chiefly confined to the streams of California and Oregon. In these the scales are large (about 135 in a lengthwise series), and the head is relatively large, forming nearly one fourth of the length to base of caudal fin. These enter the sea only when in the small coastwise streams and have usually no red under the throat.

The cutthroat forms are found from Humboldt Bay northward as far as Sitka, in the coastwise streams of northern California, Oregon, Washington, and Alaska, and all the clear streams on both sides of the Rocky Mountains, and in the Great Basin and the headwaters of the Colorado. The cutthroat trout have the scales small, about 180, and there is always a bright dash of orange-red on each side concealed beneath the branches of the lower jaw.

Along the western slope of the Sierra Nevada there are also forms of trout with the general appearance of rainbow trout and evidently belonging to that species, but with scales intermediate in number (in McCloud River), var. *shasta*, or with scales as small as in the typical cutthroat (Kern River), var. *gilberti*. In these small-scaled forms more or less red appears below the lower jaw, and they are doubtless what they appear to be, really intermediate between *clarkii* and *irideus*, although certainly nearest the latter. A similar series of forms occurs in the Columbia basin, the upper Snake being inhabited by *clarkii* and the lower Snake by *clarkii* and *gairdneri*, together with a medley of forms apparently intermediate.

It seems probable that the American trout originated in Asia, extended its range to southeast Alaska, thence southward to the Fraser and Columbia, thence to the Yellowstone and the Missouri via Two-Ocean Pass; from the Snake River to the Great Basins of Utah and Nevada; from the Missouri southward to the Platte and the Arkansas, thence from the Platte to the Rio Grande and the Colorado, and then from the Colorado again from Oregon southward c[illegible]twise and along the Sierra to

northern Mexico, thence northward and coastwise, the sea-running forms passing from stream to stream.

Of the American species the rainbow trout of California (*Salmo irideus*) most nearly approaches the European *Salmo fario*. It has the scales comparatively large, although rather smaller than in *Salmo fario*, the usual number in a longitudinal series being about 135. The mouth is smaller than in other American trout; the maxillary, except in old males, rarely extending beyond the eye. The caudal fin is well forked, becoming in very old fishes more nearly truncate. The head is relatively large, about four times in the total length. The size of the head forms the best distinctive character. The color, as in all the other species, is bluish, the sides silvery in the males, with a red lateral band, and reddish and dusky blotches. The head, back, and upper fins are sprinkled with round black spots, which are very variable in number, those in the dorsal usually in about nine rows. In specimens taken in the sea this species, like most other trout in similar conditions, is bright silvery, and sometimes immaculate. This species is especially characteristic of the waters of California. It abounds in every clear brook, from the Mexican line northward to Mount Shasta, or beyond, the species passing in the Columbia region by degrees into the variety or form known as *Salmo masoni*, the Oregon rainbow trout, a small rainbow trout common in the forest streams of Oregon, with smaller mouth and fewer spots on the dorsal. No true rainbow trout have been anywhere obtained to the eastward of the Cascade range or of the Sierra Nevada, except as artificially planted in the Truckee River. The species varies much in size; specimens from northern California often reach a weight of six pounds, while in the streams above Tia Juana in Lower California, the southernmost locality from which I have obtained trout, they seldom exceed a length of six inches. Although not usually an anadromous species, the rainbow trout frequently moves about in the rivers, and it often enters the sea, large sea-run specimens being often taken for steelheads. Several attempts have been made to introduce it in Eastern streams, but it appears to seek the sea when it is lost. It is apparently more hardy and less greedy than the American charr, or brook-trout (*Salvelinus fontinalis*). On the other hand, it is distinctly inferior to the latter in beauty and in gaminess.

Three varieties of some importance have been indicated: *Salmo irideus stonei*, the Nissui trout of the Klamath, with spots posteriorly only rarely; *Salmo irideus shasta*, of the upper Sacramento; and the small-scaled *Salmo irideus gilberti*, of the Kings and Kern rivers. In the headwaters of the Kern the waterfall of Agua-Bonita shuts off the movements of the trout. Above this fall is a dwarf form with bright golden fins, and the scales scarcely imbricated. This is the "golden trout of Mount Whitney," *Salmo irideus agua-bonita*. It will

probably be found to change back to the original type if propagated in different waters.

In beauty of color, gracefulness of form and movement, sprightliness when in the water, reckless dash with which it springs from the water to meet the descending fly ere it strikes the surface, and the mad and repeated leaps from the water when hooked, the rainbow trout must ever hold a very high rank. "The gamest fish we have ever seen," writes Dr. Evermann, "was a 16-inch rainbow taken on a fly in a small spring branch tributary of Williamson River in southern Oregon. It was in a broad and deep pool of exceedingly clear water. As the angler from behind a clump of willows made the cast the trout bounded from the water and met the fly in the air a foot or more above the surface; missing it he dropped upon the water, only to turn about and strike viciously a second time at the fly just as it touched the surface; though he again missed the fly, the hook caught him in the lower jaw from the outside, and then began a fight which would delight the heart of any angler. His first effort was to reach the bottom of the pool, then, doubling upon the line, he made three jumps from the water in quick succession, clearing the surface in each instance from one to four feet, and every time doing his utmost to free himself from the hook by shaking his head as vigorously as a dog shakes a rat. Then he would rush wildly about in the large pool, now attempting to go down over the riffle below the pool, now trying the opposite direction, and often striving to hide under one or the other of the banks. It was easy to handle the fish when the dash was made up or down stream or for the opposite side, but when he turned about and made a rush for the protection of the overhanging bank upon which the angler stood it was not easy to keep the line taut. Movements such as these were frequently repeated, and two more leaps were made. But finally he was worn out after as honest a fight as trout ever made."

"The rainbow takes the fly so readily that there is no reason for resorting to grasshoppers, salmon eggs, or other bait. It is a fish whose gaminess will satisfy the most exacting of expert anglers and whose readiness to take any proper line will please the most impatient of inexperienced amateurs."

The steelhead (*Salmo rivularis*) is a large trout, reaching 12 to 20 pounds in weight, found abundantly in river estuaries and sometimes in lakes from Lynn Canal to Santa Barbara. The spent fish abound in the rivers in spring at the time of the salmon run. The species is rarely canned, but is valued for shipment in cold storage. Its bones are much more firm than those of the salmon—a trait unfavorable for canning purposes. The flesh when not spent after spawning is excellent. The steelhead does not die after spawning, as all the Pacific salmon do.

It is thought by some anglers that the young fish hatched in the

brooks from eggs of the steelhead remain in mountain streams from six to thirty-six months, going down to the sea with the high waters of spring, after which they return to spawn as typical steelhead trout. I now regard this view as unfounded. In my experience the rainbow and the steelhead are always distinguishable: the steelhead abounds where the rainbow trout is unknown; the scales in the steelhead are always smaller (about 155) than in typical rainbow trout; finally, the small size of the head in the steelhead is always distinctive.

The Kamloops trout, described by the writer from the upper Columbia, seems to be a typical steelhead as found well up the rivers away from the sea. Derived from the steelhead, but apparently quite distinct from it, are three very noble trout, all confined so far as yet known to Lake Crescent in northwestern Washington. These are the crescent trout, *Salmo crescentis*, the Beardslee trout, *Salmo beardsleei*, and the long-headed trout, *Salmo bathœcetor*. The first two, discovered by Admiral L. A. Beardslee, are trout of peculiar attractiveness and excellence. The third is a deep-water form, never rising to the surface, and caught only on set lines. Its origin is still uncertain, and it may be derived from some type other than the steelhead.

Cutthroat or Red-throated Trout.—This species has much smaller scales than the rainbow trout or steelhead, the usual number in a longitudinal series being 160 to 170. Its head is longer (about four times in length to base of caudal). Its mouth is proportionately larger, and there is always a narrow band of small teeth on the hyoid bone at the base of the tongue. These teeth are always wanting in *Salmo irideus* and *rivularis*, in which species the rim of the tongue only has teeth. The color in *Salmo clarkii* is, as in other species, exceedingly variable. In life there is always a deep-red blotch on the throat, between the branches of the lower jaw and the membrane connecting them. This is not found in other species, or is reduced to a narrow strip or pinkish shade. It seems to be constant in all varieties of *Salmo clarkii*, at all ages, thus furnishing a good distinctive character. It is the sign manual of the Sioux Indians, and the anglers have already accepted from this mark the name of cutthroat trout. The cutthroat trout of some species is found in every suitable river and lake in the Great Basin of Utah, in the streams of Colorado, Wyoming, and Montana, on both sides of the Rocky Mountains. It is also found throughout Oregon, Washington, Idaho, British Columbia, the coastwise islands of southeastern Alaska (Baranof, etc.), to Kadiak and Bristol Bay, probably no stream or lake suitable for trout-life being without it. In California the species seems to be comparatively rare, and its range rarely extending south of Cape Mendocino. Large sea-run individuals analogous to the steelheads are sometimes found in the mouth of the Sacramento. In Washington and Alaska this species

regularly enters the sea. In Puget Sound it is a common fish. These sea-run individuals are more silvery and less spotted than those found in the mountain streams and lakes. The size of *Salmo clarkii* is subject to much variation. Ordinarily four to six pounds is a large size; but in certain favored waters, as Lake Tahoe, and the fjords of southeastern Alaska, specimens from 20 to 30 pounds are occasionally taken.

Those species or individuals dwelling in lakes of considerable size, where the water is of such temperature and depth as insures an ample food-supply, will reach a large size, while those in a restricted environment, where both the water and food are limited, will be small directly in proportion to these environing restrictions. The trout of the Klamath Lakes, for example, reach a weight of at least 17 pounds, while in Fish Lake in Idaho mature trout do not exceed 8 to 9¼ inches in total length or one-fourth pound in weight. In small creeks in the Sawtooth Mountains and elsewhere they reach maturity at a length of 5 or 6 inches, and are often spoken of as brook-trout and with the impression that they are a species different from the larger ones found in the lakes and larger streams. But as all sorts and gradations between these extreme forms may be found in the intervening and connecting waters, the differences are not even of subspecific significance.

Dr. Evermann observes: "The various forms of cutthroat trout vary greatly in game qualities; even the same subspecies in different waters, in different parts of its habitat, or at different seasons, will vary greatly in this regard. In general, however, it is perhaps a fair statement to say that the cutthroat trout are regarded by anglers as being inferior in gaminess to the Eastern brook-trout. But while this is true, it must not by any means be inferred that it is without game qualities, for it is really a fish which possesses those qualities in a very high degree. Its vigor and voraciousness are determined largely, of course, by the character of the stream or lake in which it lives. The individuals which dwell in cold streams about cascades and seething rapids will show marvelous strength and will make a fight which is rarely equaled by its Eastern cousin; while in warmer and larger streams and lakes they may be very sluggish and show but little fight. Yet this is by no means always true. In the Klamath Lakes, where the trout grow very large and where they are often very logy, one is occasionally hooked which tries to the utmost the skill of the angler to prevent his tackle from being smashed and at the same time save the fish."

Of the various forms derived from *Salmo clarkii*, some mere varieties, some distinct species, the following are among the most marked:

Salmo henshawi, the trout of Lake Tahoe and its tributaries and outlet, Truckee River, found in fact also in the Humboldt and the Carson and throughout the basin of the former glacial lake called Lake Lahontan. This is a distinct species from *Salmo clarkii* and must be regarded

as the finest of all the cutthroat trout. It is readily known by its spotted belly, the black spots being evenly scattered over the whole surface of the body, above and below. This is an excellent game-fish, and from Lake Tahoe and Pyramid Lake it is brought in large numbers to the markets of San Francisco. In the depths of Lake Tahoe, which is the finest mountain lake of the Sierra Nevada, occurs a very large variety which spawns in the lake, *Salmo henshawi tahoensis*. This reaches a weight of twenty-eight pounds.

In the Great Basin of Utah is found a fine trout, very close to the ordinary cutthroat of the Columbia, from which it is derived. This is known as *Salmo clarkii virginalis*. In Utah Lake it reaches a large size.

In Waha Lake in Washington, a lake without outlet, is found a small trout with peculiar markings, called *Salmo clarkii bouvieri*.

In the headwaters of the Platte and Arkansas rivers is the small green-back trout, green or brown, with red throat-patch and large black spots. This is *Salmo clarkii stomias*, and it is especially fine in St. Vrain's River and the streams of Estes Park. In Twin Lakes, a pair of glacial lakes tributary of the Arkansas near Leadville, is found *Salmo clarkii macdonaldi*, the yellow-finned trout, a large and very handsome species living in deep water, and with the fins golden yellow. This approaches the Colorado trout, *Salmo clarkii pleuriticus*, and it may be derived from the latter, although it occurs in the same waters as the very different green-back trout, or *Salmo clarkii stomias*.

Two fine trout derived from *Salmo clarkii* have been lately discovered by Dr. Daniel G. Elliot in Lake Southerland, a mountain lake near Lake Crescent, but not connected with it, the two separated from the sea by high waterfalls. These have been described by Dr. Seth E. Meek as *Salmo jordani*, the "spotted trout" of Lake Southerland, and *Salmo declivifrons*, the "salmon trout." These seem to be distinct forms or sub-species produced through isolation.

The Rio Grande trout (*Salmo clarkii spilurus*) is a large and profusely spotted trout, found in the headwaters of the Rio Grande, the mountain streams of the Great Basin of Utah, and as far south as the northern part of Chihuahua. Its scales are still smaller than those of the ordinary cutthroat trout, and the black spots are chiefly confined to the tail. Closely related to it is the trout of the Colorado Basin, *Salmo clarkii pleuriticus*, a large and handsome trout with very small scales, much sought by anglers in western Colorado, and abounding in all suitable streams throughout the Colorado Basin.

Hucho, the Huchen.—The genus *Hucho* has been framed for the Huchen or Rothfisch (*Hucho hucho*) of the Danube, a very large trout, differing from the genus *Salmo* in having no teeth on the shaft of the vomer, and from the *Salvelini* at least in form and coloration. The

huchen is a long and slender, somewhat pike-like fish, with depressed snout and strong teeth. The color is silvery, sprinkled with small black dots. It reaches a size little inferior to that of the salmon, and it is said to be an excellent food-fish. In northern Japan is a similar species, *Hucho blackistoni*, locally known as Ito, a large and handsome trout with very slender body, reaching a length of 2½ feet. It is well worthy of introduction into American and European waters.

Salvelinus, the Charr.—The genus *Salvelinus* comprises the finest of the *Salmonidæ*, from the point of view of the angler or the artist. In England the species are known as charr or char, in contradistinction to the black-spotted species of *Salmo*, which are called trout. The former name has unfortunately been lost in America, where the name "trout" is given indiscriminately to both groups, and, still worse, to numerous other fishes (*Microperus*, *Hexagrammos*, *Cynoscion*, *Agonostomus*) wholly unlike the *Salmonidæ* in all respects. It is sometimes said that "the American brook-trout is no trout, nothing but a charr," almost as though "charr" were a word of reproach. Nothing higher, however, can be said of a salmonoid than that it is a "charr." The technical character of the genus *Salvelinus* lies in the form of its vomer. This is deeper than in *Salmo;* and when the flesh is removed the bone is found to be somewhat boat-shaped above, and with the shaft depressed and out of the line of the head of the vomer. Only the head or chevron is armed with teeth, and the shaft is covered by skin.

In color all the charrs differ from the salmon and trout. The body in all is covered with round spots which are paler than the ground color, and crimson or gray. The lower fins are usually edged with bright colors. The sexual differences are not great. The scales, in general, are smaller than in other *Salmonidæ*, and they are imbedded in the skin to such a degree as to escape the notice of casual observers and even of most anglers.

> "One trout scale in the scales I'd lay
> (If trout had scales), and 'twill outweigh
> The wrong side of the balances."—Lowell.

The charrs inhabit, in general, only the clearest and coldest of mountain streams and lakes, or bays of similar temperature. They are not migratory, or only to a limited extent. In northern regions they descend to the sea, where they grow much more rapidly and assume a nearly uniform silvery-gray color. The different species are found in all suitable waters throughout the northern parts of both continents, except in the Rocky Mountains and Great Basin, where only the black-spotted trout occur. The number of species of charr is very uncertain, as, both in America and Europe, trivial variations and individual peculiarities have been raised to the rank of species. More types, however, seem to be represented in America than in Europe.

The only really well-authenticated species of charr in European waters is the red charr, sälbling, or ombre chevalier (*Salvelinus alpinus*). This species is found in cold, clear streams in Switzerland, Germany, and throughout Scandinavia and the British Islands. Compared with the American charr or brook-trout, it is a slenderer fish, with smaller mouth, longer fins, and smaller red spots, which are confined to the sides of the body. It is a "gregarious and deep-swimming fish, shy of taking the bait and feeding largely at night-time. It appears to require very pure and mostly deep water for its residence." It is less tenacious of life than the trout. It reaches a weight of from one to five pounds, probably rarely exceeding the latter in size. The various charr described from Siberia are far too little known to be enumerated here.

Of the American charr the one most resembling the European species is the Rangeley lake-trout (*Salvelinus oquassa*). The exquisite little fish is known in the United States only from the Rangeley chain of lakes in western Maine. This is very close to the Greenland charr, *Salvelinus stagnalis*, a beautiful species of the far north. The Rangeley trout is much slenderer than the common brook-trout, with much smaller head and smaller mouth. In life it is dark blue above, and the deep-red spots are confined to the sides of the body. The species rarely exceeds the length of a foot in the Rangeley Lakes, but in some other waters it reaches a much larger size. So far as is known it keeps itself in the depths of the lake until its spawning season approaches, in October, when it ascends the stream to spawn.

Still other species of this type are the Sunapee trout, *Salvelinus aureolus*, a beautiful charr almost identical with the European species, found in numerous ponds and lakes of eastern New Hampshire and neighboring parts of Maine. Mr. Garman regards this trout as the offspring of an importation of the ombre chevalier and not as a native species, and in this view he may be correct. *Salvelinus alipes* of the far north may be the same species. Another remarkable form is the Lac de Marbre trout of Canada, *Salvelinus marstoni* of Garman.

In Arctic regions another species, called *Salvelinus naresi*, is very close to *Salvelinus oquassa* and may be the same.

Another beautiful little charr, allied to *Salvelinus stagnalis*, is the Floeberg charr (*Salvelinus arcturus*). This species has been brought from Victoria Lake and Floeberg Beach, in the extreme northern part of Arctic America, the northernmost point whence any salmonoid has been obtained.

The American charr, or, as it is usually called, the brook-trout (*Salvelinus fontinalis*), although one of the most beautiful of fishes, is perhaps the least graceful of all the genuine charrs. It is technically distinguished by the somewhat heavy head and large mouth, the maxillary bone reaching more or less beyond the eye. There are no teeth

on the hyoid bone, traces at least of such teeth being found in nearly all other species. Its color is somewhat different from that of the others, the red spots being large and the black more or less mottled and barred with darker olive. The dorsal and caudal fins are likewise barred or mottled, while in the other species they are generally uniform in color. The brook-trout is found only in streams east of the Mississippi and Saskatchewan. It occurs in all suitable streams of the Alleghany region and the Great Lake system, from the Chattahoochee River in northern Georgia northward at least to Labrador and Hudson Bay, the northern limits of its range being as yet not well ascertained. It varies greatly in size, according to its surroundings, those found in lakes being larger than those resident in small brooks. Those found farthest south, in the headwaters of the Chattahoochee, Savannah, Catawba, and French Broad, rarely pass the dimensions of fingerlings. The largest specimens are recorded from the sea along the Canadian coast. These frequently reach a weight of ten pounds; and from their marine and migratory habits, they have been regarded as forming a distinct variety (*Salvelinus fontinalis immaculatus*), but this form is merely a sea-run brook-trout. The largest fresh-water specimens rarely exceed seven pounds in weight. Some unusually large brook-trout have been taken in the Rangeley Lakes, the largest known to me having a reputed weight of eleven pounds. The brook-trout is the favorite game-fish of American waters, preëminent in wariness, in beauty, and in delicacy of flesh. It inhabits all clear and cold waters within its range, the large lakes and the smallest ponds, the tiniest brooks and the largest rivers; and when it can do so without soiling its aristocratic gills on the way, it descends to the sea and grows large and fat on the animals of the ocean. Although a bold biter it is a wary fish, and it often requires much skill to capture it. It can be caught, too, with artificial or natural flies, minnows, crickets, worms, grasshoppers, grubs, the spawn of other fish, or even the eyes or cut pieces of other trout. It spawns in the fall, from September to late in November. It begins to reproduce at the age of two years, then having a length of about six inches. In springtime the trout delight in rapids and swiftly running water; and in the hot months of midsummer they resort to deep, cool, and shaded pools. Later, at the approach of the spawning season, they gather around the mouths of cool, gravelly brooks, whither they resort to make their beds. (Hallock.)

The brook-trout adapts itself readily to cultivation in artificial ponds. It has been successfully transported to Europe, and it is already abundant in certain streams in England, in California, and elsewhere.

In Dublin Pond, New Hampshire, is a gray variety, without red spots, called *Salvelinus agassizi*.

The "Dolly Varden" trout, or malma (*Salvelinus malma*), is very

similar to the brook-trout, closely resembling it in size, form, color, and habits. It is found always to the westward of the Rocky Mountains, in the streams of northern California, Oregon, Washington, and British Columbia, Alaska, and Kamtchatka, as far as the Kurile Islands. It abounds in the sea in the northward, and specimens of 10 to 12 pounds weight are not uncommon in Puget Sound and especially in Alaska. The Dolly Varden trout is, in general, slenderer and less compressed than the Eastern brook-trout. The red spots are found on the back of the fish as well as on the sides, and the back and upper fins are without the blackish marblings and blotches seen in *Salvelinus fontinalis*. In value as food, in beauty, and in gaminess, *Salvelinus malma* is very similar to its Eastern cousin.

In Alaska the Dolly Varden, locally known as salmon trout, is very destructive to the eggs of the salmon, and countless numbers are taken in the salmon nets of Alaska and thrown away as useless by the canners. In every coastwise stream of Alaska the water fairly "boils" with these trout. They are, however, not found in the Yukon. In northern Japan occurs *Salvelinus plurius*, the Iwana, a species very similar to the Dolly Varden, but not so large or so brightly colored. In the Kurile region and Kamtchatka is another large charr, *Salvelinus kundscha*, with the spots large and cream-color instead of crimson.

Cristivomer, the Great Lake Trout.—Allied to the true charrs, but now placed by us in a different genus, *Cristivomer*, is the Great Lake trout, otherwise known as Mackinaw trout, longe, or togue (*Cristivomer namaycush*). Technically this fish differs from the true charrs in having on its vomer a raised crest behind the chevron and free from the shaft. This crest is armed with strong teeth. There are also large hooked teeth on the hyoid bone, and the teeth generally are proportionately stronger than in most of the other species. The Great Lake trout is grayish in color, light or dark according to its surroundings; and the body is covered with round paler spots, which are gray instead of red. The dorsal and caudal fins are marked with darker reticulations, somewhat as in the brook-trout. This noble species is found in all the larger lakes from New England and New York to Wisconsin, Montana, the Mackenzie River, and in all the lakes tributary to the Yukon in Alaska. We have taken examples from Lake Bennett, Lake Tagish, Summit Lake (White Pass), and have seen specimens from Lake La Hache in British Columbia. It reaches a much larger size than any *Salvelinus*, specimens of from 15 to 20 pounds weight being not uncommon, while it occasionally attains a weight of 50 to 80 pounds. As a food-fish it ranks high, although it may be regarded as somewhat inferior to the brook-trout or the whitefish. Compared with other salmonoids, the Great Lake trout is a sluggish, heavy, and ravenous fish. It has been known to eat raw potato, liver, and corn-cobs,—refuse thrown from

passing steamers. According to Herbert, "a coarse, heavy, stiff rod, and a powerful oiled hempen flaxen line, on a winch, with a heavy sinker; a cod-hook, baited with any kind of flesh, fish, or fowl,—is the most successful, if not the most orthodox or scientific, mode of capturing him. His great size and immense strength alone give him value as a fish of game; but when hooked he pulls strongly and fights hard, though he is a boring, deep fighter, and seldom if ever leaps out of the water, like the true salmon or brook-trout."

In the depths of Lake Superior is a variety of the Great Lake trout known as the Siscowet (*Cristivomer namaycush siskawitz*), remarkable for its extraordinary fatness of flesh. The cause of this difference lies probably in some peculiarity of food as yet unascertained.

THE PARENT-STREAM THEORY OF THE RETURN OF SALMON.

By DAVID STARR JORDAN,
President of Leland Stanford Junior University.

[From the Popular Science Monthly, November, 1903.]

It has been generally accepted as unquestioned, by packers and fishermen, that the salmon of the Pacific (king salmon, red salmon, silver salmon, humpback salmon, and dog salmon) all return to spawn to the very stream in which they were hatched. As early as 1880, the present writer placed on record his opinion that this theory was unsound. In a general way, most salmon return to the parent stream, because when in the sea the parent stream is the one most easily reached. The channels and runways which directed their course to the sea may influence their return trip in the same fashion. When the salmon is mature, the spawning season approaching, it seeks fresh water. Other things being equal, about the same number will run each year in the same channel. With all this, we find some curious facts. Certain streams will have a run of exceptionally large or exceptionally small red salmon. The time of the run bears some relation to the length of the stream: those who have farthest to go start earliest. The time of running bears also a relation to the temperature of the spawning grounds—where the waters cool off earliest, the fish run soonest.

The supposed evidence in favor of the parent-stream theory may be considered under three heads:* (1) Distinctive runs in various streams, (2) Return of marked salmon, (3) Introduction of salmon into new streams followed by their return.

Under the first head it is often asserted of fishermen that they can distinguish the salmon of different streams. Thus the Lynn Canal red salmon are larger than those in most waters, and it is claimed that those of Chilcoot Inlet are larger than those of the sister streams at Chilcat. The red salmon of Red Fish Bay on Baranof Island (near Sitka) are said to be much smaller than usual, and those of the neighboring Necker Bay are not more than one third the ordinary size. Those of a small,

*See an excellent article by H. S. Davis in the "Pacific Fisherman" for July, 1903.

rapid stream near Nass River are more wiry than those of the neighboring large stream. The same claim is made for the different streams of Puget Sound, each one having its characteristic run. In all this there is some truth and perhaps more exaggeration. I noticed that the Chilcoot fish seemed deeper in body than those at Chilcat. The red salmon becomes compressed before spawning, and the Chilcoot fishes having a short run spawn earlier than the Chilcat fishes, which have many miles to go, the water being perhaps warmer at the mouth of the river which flows farthest from the parent ice-fields. The riper fishes run up the shorter river. In Bristol Bay, according to Dr. Gilbert, the great runs ascend sometimes one river, sometimes another. Perhaps some localities may meet the nervous reactions of small fishes while not attracting the large ones. In Necker Bay a few full-grown salmon run besides the little ones. A few dwarf individuals, two and three year olds, ripened prematurely, run in every salmon stream. These little fishes are nearly all males. Mr. H. S. Davis well observes that "until a constant difference has been demonstrated by a careful examination of large numbers of fish from each stream taken *at the same time*, but little weight can be attached to arguments of this nature."

It is doubtless true as a general proposition that nearly all salmon return to the region in which they were spawned. Most of them apparently never go far away from the mouth of the stream or the bay into which it flows. It is true that salmon are occasionally taken well out at sea and it is certain that the red salmon runs of Puget Sound come from outside the Straits of Fuca. There is, however, evidence that most species rarely go so far as that. When seeking shore, they usually reach the original channels.

In 1880, the writer, studying the king salmon of the Columbia, used the following words, which he has not had occasion to change :

It is the prevailing impression that the salmon have some special instinct which leads them to return to spawn in the same spawning grounds where they were originally hatched. We fail to find any evidence of this in the case of the Pacific Coast salmon, and we do not believe it to be true. It seems more probable that the young salmon hatched in any river mostly remain in the ocean within a radius of twenty, thirty or forty miles of its mouth. These, in their movement about in the ocean may come into contact with the cold waters of their parent rivers, or perhaps of any other river, at a considerable distance from the shore. In the case of the quinnat and the blueback, their "instinct" seems to lead them to ascend these fresh waters, and in a majority of cases these waters will be those in which the fishes in question were originally spawned. Later in the season the growth of the reproductive organs leads them to approach the shore and search for fresh waters, and still the chances are that they may find the original stream. But undoubtedly many fall salmon ascend, or try to ascend, streams in which no salmon was ever hatched. In little brooks about Puget Sound, where the water is not three inches deep, are often found dead or dying salmon, which have entered them for the purpose of spawning. It is said of the Russian River and other California rivers, that their mouths, in the time of low water in summer, generally become entirely closed by sandbars, and that the salmon, in their eagerness to ascend them, frequently fling themselves entirely out of water on the beach. But this does not prove that the salmon are guided by a marvelous geographical instinct which leads them to

their parent river in spite of the fact that the river can not be found. The waters of Russian River soak through these sandbars, and the salmon instinct, we think, leads them merely to search for fresh waters. This matter is much in need of further investigation; at present, however, we find no reason to believe that the salmon enter the Rogue River simply because they were spawned there, or that a salmon hatched in the Clackamas River is more likely, on that account, to return to the Clackamas than to go up the Cowlitz or the Des Chûtes.

Attempts have been made to settle this question by marking the fry. But this is a very difficult matter, indeed. Almost the only structure which can be safely mutilated is the adipose fin, and this is often nipped off by sticklebacks and other meddling fish. The following experiments have been tried, according to Mr. Davis:

In March, 1896, 5,000 king salmon fry were marked by cutting off the adipose fin, then set free in the Clackamas River. Nearly 400 of these marked fish are said to have been taken in the Columbia in 1898 and a few more in 1899. In addition a few were taken in 1898, 1899 and 1900 in the Sacramento River, but in much less numbers than in the Columbia. In the Columbia most were taken at the mouth of the river where most of the fishing was done, but a few were in the original stream, the Clackamas. It is stated that the fry thus set free in the Clackamas came from eggs obtained in the Sacramento—a matter which has, however, no bearing on the present case.

In the Kalama hatchery on the Columbia River, Washington, 2,000 fry of the quinnat or king salmon were marked in 1899 by a V-shaped notch in the caudal fin. Numerous fish thus marked were taken in the lower Columbia in 1901 and 1902. A few were taken at the Kalama hatchery, but some also at the hatcheries on Wind River and Clackamas River. At the hatchery on Chehalis River six or seven were taken, the stream not being a tributary of the Columbia, but flowing into Shoalwater Bay. None were noticed in the Sacramento. The evidence shows that the most who are hatched in a large stream tend to return to it, and that in general, most salmon return to the parent region.

There is no evidence that a salmon hatched in one branch of a river tends to return there rather than to any other. Experiments of Messrs. Rutter and Spalding in marking adult fish at Karluk would indicate that they roam rather widely about the island before spawning. A spawning fish set free in Karluk River was found three days later at Red River, sixty miles away on the opposite side of Kadiak Island.

The introduction of salmon into new streams may throw some light on this question. In 1897 and 1898, 3,000,000 young king salmon fry were set free in Papermill Creek near Olema, California. This is a small stream flowing into the head of Tomales Bay, and it had never previously had a run of salmon. In 1900, and especially in 1901, large quinnat salmon appeared in considerable numbers in this stream. One specimen weighing about sixteen pounds was sent to the present writer for identification. These fishes certainly returned to the parent stream, although this stream was one not at all fitted for their purpose.

But this may be accounted for by the topography of the bay. Tomales Bay is a long and narrow channel, about twenty miles long and from one to five in width, isolated from other rivers, and with but one tributary stream. Probably the salmon had not wandered far from it; some may not have left it at all. In any event, a large number certainly came back to the same place.

That the salmon rarely go far away is fairly attested. Schools of king salmon play in Monterey Bay, and others chase the herring about in the channels of southeastern Alaska. A few years since, Captain J. F. Moser, in charge of the Albatross, set gill nets for salmon at various places in the sea off the Oregon and Washington coast, catching none except in the bays.

Mr. Davis gives an account of the liberation of salmon in Chinook River, which flows into the Columbia at Baker's Bay:

> It is a small, sluggish stream and has never been frequented by Chinook salmon, although considerable numbers of silver and dog salmon enter it late in the fall. A few years ago the State established a hatchery on this stream, and since 1898 between 1,000,000 and 2,000,000 Chinook fry have been turned out here annually. The fish are taken from the pound-nets in Baker's Bay, towed into the river in crates and then liberated above a dike which prevents their return to the Columbia. When ripe, the salmon ascend to the hatchery, some two or three miles farther up the river, where they are spawned.
>
> The superintendent of the hatchery, Mr. Nic Hansen, informs me that in 1902, during November and December, quite a number of Chinook salmon ascended the Chinook River. About 150 salmon of both sexes were taken in a trap located in the river about four miles from its mouth. At first thought it would appear that these were probably fish which, when fry, had been liberated in the river, but unfortunately there is no proof that this was the case. According to Mr. Hansen, the season of 1902 was remarkable in that the salmon ran inshore in large schools, a thing which they had not done before for years. It is possible that the fish, being forced in close to the shore, came in contact with the current from the Chinook River, which, since the stream is small and sluggish, would not be felt far from shore. Once brought under the influence of the current from the river the salmon would naturally ascend that stream, whether they had been hatched there or not.

The general conclusion, apparently warranted by the facts at hand, is that the Pacific salmon, for the most part, do not go to a great distance from the stream in which they are hatched, that most of them return to the streams of the same region, a majority to the parent stream, but that there is no evidence that they choose the parental spawning grounds in preference to any other, and none that they will prefer an undesirable stream to a favorable one for the reason that they happen to have been hatched in the former.

Mr. John C. Callbreath, of Wrangel, Alaska, has long conducted a very interesting but very costly experiment in this line. About 1890, he established himself in a small stream called Jadgeska on the west coast of Etolin Island, tributary to McHenry Inlet, Clarence Straits. This stream led from a lake, and in it a few thousand red salmon spawned, besides multitudes of silver salmon, dog salmon, and humpback salmon. Making a dam across the stream, he helped the red salmon over it, destroying all the inferior kinds which entered the stream. He also established a hatchery for the red salmon, turning loose many thousand fry each year for about twelve years. This was done in the expectation that all the salmon hatched would return to Jadgeska in about four years. By destroying all individuals of other species attempt-

ing to run, it was expected that these would become extinct so far as the stream is concerned.

The result of this experiment has been disappointment. After twelve years or more there has been no increase of red salmon in the stream, and no decrease of humpbacks and other humbler forms of salmon. Mr. Callbreath draws the conclusion that salmon run at a much greater age than has been supposed—perhaps at the age of sixteen years, instead of four. A far more probable conclusion is that the salmon set free by him have joined other bands bound for more suitable streams. It is indeed claimed that since the establishment of Callbreath's hatchery on Etolin Island, there has been a notable increase of the salmon run in various streams of Prince of Wales Island on the opposite side of Clarence Straits. But this statement, while largely current among the cannery men, and not improbable, needs verification.

We shall await with much interest the return of the millions of young salmon hatched in 1902, and turned loose in Naha stream. We may venture the prophecy that while a large percentage will return to Loring, many others will enter Yes Bay, Karta Bay, Moira Sound, and other red salmon waters along the line of their return from Dixon Entrance or the open sea.

ARTIFICIAL PROPAGATION OF SALMON IN THE SACRAMENTO RIVER.

By CLOUDSLEY RUTTER.

By courtesy of San Francisco Trade Journal.

Editor Trade Journal: After this generally poor season for salmon fisheries the question of artificial propagation is sure to be discussed, and I have already heard numerous complaints about its inefficiency. These complaints seem to me to be more or less unreasonable, and yet as they have a foundation in a fact, that is, in the small catch, and as it has been a large part of my work during the past several years to investigate both artificial and natural propagation, I shall be glad if you will publish my views on the question, which I send herewith.

Cannerymen and fishermen demand too much of the hatcheries. If there is not a big run of fish every season, the hatchery is a failure. In no other industry is such a demand made. Every few years there is a scarcity of cattle or hogs or bees, yet no one claims on that account that stock-breeding or bee-culture is a failure. The only difference is that we can determine the cause when there is a failure of cattle or hogs or bees, whereas we can not tell what destroys the salmon.

For the sake of argument, let us suppose that natural propagation is as efficient as artificial propagation, which averages above 85 per cent for the time that the two methods come into competition. That is, 85 per cent of the eggs taken by the hatcheries produce healthy fry ready for the ocean, after which time the product of artificial propagation has neither an advantage nor a disadvantage as compared with that from natural propagation; the conditions of the two are identical. And if we grant that natural propagation is equally effective with artificial, 85 per cent of all eggs deposited must produce fry ready for the ocean. That is, for each pair of quinnat salmon that spawn naturally, 5,100 fry begin their migration toward the ocean. Call it 5,000 for convenience. That makes 2,500 for each spawning salmon, male and female; or stated in another way, the increase is 2,500 fold.

Now, on an average from year to year, the number of salmon remains about the same. Therefore, 2,499 of these 2,500 swimming fishes must

perish, else there will be an increase. If only 2,498 perish there will be two survivors among the offspring of each salmon, four for each pair, and the increase will be one hundred fold. The conclusion is, therefore, that while only 15 per cent of the young are destroyed during the helpless stage before they are able to swim, including the egg stage, yet of those that do arrive at the age when they can swim and are supposed to be able to take care of themselves, 99.9 per cent perish before coming to maturity, which is absurd.

In fact, we know the contrary to be true. We see predaceous fishes and ducks gorging themselves with eggs and with alevins; we find dead eggs in the gravel very much more abundant than live eggs; we see the late spawning fishes tearing up the spawning beds of the earlier spawning fishes and killing the eggs in this way; and we see freshets covering the spawning beds with gravel or washing them away. We do not know, of course, what percentage is destroyed in this way, but none of these mishaps affect artificial propagation. The loss in artificial propagation lies almost wholly in eggs dying during incubation, and it is highly probable that such would die under any conditions.

Nothing is said above about the completeness of fertilization in natural propagation, for the reason that there are but little data on this point. What little we have point to a high percentage, but it can hardly exceed that of artificial propagation, which is practically complete, 99 per cent.

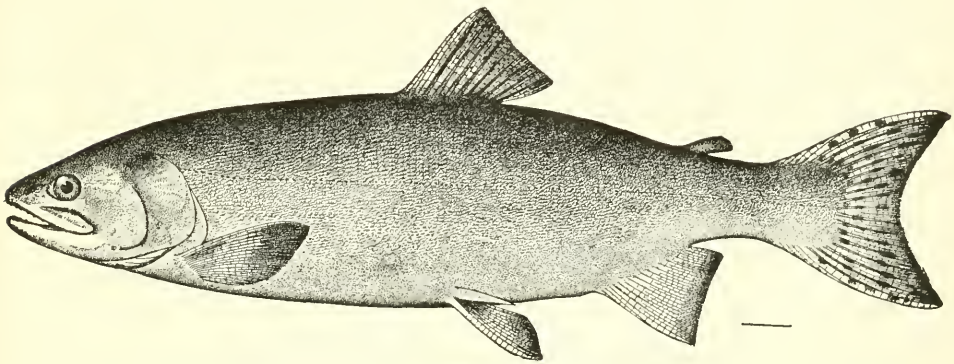
I do not mean to claim that artificial propagation is absolutely perfect, that there is no room for improvement; but the question of the improvement in methods is hardly pertinent to the present subject. The writer, in his report on the "Natural History of the Quinnat Salmon in the Sacramento River," gives as his personal opinion that the relative efficiency of natural and artificial propagation is about one per cent and eighty-five per cent respectively. (Bull. U. S. Fish Com., 1902, p. 137.) Further investigation only shows natural propagation to be of less value, if possible, than there stated.

There have been enough eggs deposited in the little streams tributary to Karluk Lake, Kadiak Island, Alaska, during the past season that more than two might be placed on each square foot of the surface of the lake, which comprises about fifty square miles! And this has been the poorest season ever known at that place. Surely if natural propagation approached anywhere near the efficiency of artificial propagation the ocean would be completely overrun with salmon. Think of 2,287,840,000 fry coming down one small river!

In general, there are two main causes for a scarcity of fish—a dearth of food, and a superabundance of enemies. The food of the growing salmon is largely small fishes. These may be scarce from ineffective propagation, lack of food, or superabundance of enemies, just as the salmon may be. But whatever the cause, if the small fishes are scarce, the salmon will go hungry or seek other feeding-grounds.

The superabundance of enemies is probably the most important factor in limiting the number of salmon. Their enemies during the egg and alevin stage have been mentioned above. After beginning to swim, the young salmon is a very active fish, and during his migration down the rivers to the ocean, when the young from the hatcheries are first exposed to the same dangers as those from the natural spawning beds, he is in no great danger from birds or fishes, with the exception of the Dolly Varden trout. While in fresh water the young salmon is too small to receive the attention of fish ducks, which feed largely on sculpins or minnows, while the cormorants feed on carp and (in Alaska) on trout that are larger than the young salmon.

We do not know the enemies in salt water, except that the quinnat feeds to some extent on young salmon. But other enemies are numerous enough. I recently examined 500 adult salmon for the pur-



QUINNAT, OR SACRAMENTO RIVER, SALMON.

pose of determining the number that had been injured in any way, as shown by scars, scratches, and scale abrasions, with the result showing that 11 per cent had received at least some slight injury, and that 5 per cent carried scars indicating that they had had really close calls for their lives. When 11 per cent have been in danger, and when 5 per cent have barely escaped with their lives, how many must there have been that did not escape? It seems certain that the salmon taken by the fishermen, numerous though they may be, are only a few in comparison with the number that perish before they meet the fishermen. Artificial propagation must not be held responsible for the safety of the fish among these dangers. And whatever the output of young from the hatcheries or from natural spawning beds, there are sure to be years of scarcity.

Artificial propagation of salmon has not yet reached such proportions as to entirely supplant natural propagation, with the exception of the work on the Sacramento River, and until such condition is reached,

ample provision must be made for salmon reaching their natural spawning beds. But this necessity fishermen do not heed. When the enemies of the salmon have been particularly abundant, and there is therefore a slack run, instead of fishing lightly and permitting as many as possible to ascend to the spawning streams, the contrary is the practice. The amount of fishing is quadrupled during poor years, and every fish that it is possible to take is taken, with the immediate result that but few salmon reach the spawning beds, and with the ultimate result that the small run will not only be repeated when the resulting offspring return as adults, but that it will be accentuated. Surely it will require great efforts on the part of artificial propagation to overcome the double odds of natural and human enemies, but of its ability to do so I have not the slightest doubt.

Artificial propagation is keeping up the supply of salmon in the Sacramento River. With one exception, there are now no natural spawning beds in the Sacramento basin that amount to anything. All of the Feather, Upper Sacramento, and Pit rivers, with their tributaries, have been practically abandoned, with the exception of the streams where the hatcheries are located. The only natural spawning beds still occupied are in the main river, between Redding and Tehama, which are yet visited by a considerable number of salmon. Otherwise, the salmon fisheries in the Sacramento are being kept up by the hatcheries; and what is being done in California can be done elsewhere.

1903. CLOUDSLEY RUTTER.

ADDENDA.—REPORT ON SALMON EGGS, 1904.

Since the foregoing has gone to print, other important and interesting figures relating to the take of salmon eggs at the Battle Creek and Mill Creek stations for the season of 1904 have become available, which would seem to bear out strongly the opinion of Mr. Rutter as to the value of artificial propagation of salmon in the Sacramento River.

In the report of Superintendent Shebley, of the Sisson hatchery, attention is called to his statement that the total number of salmon eggs handled at that station for 1903 aggregated 58,632,000, of which he says: "This was the largest number of salmon eggs ever hatched at one station in one season. It is the best record of any station on the Pacific Coast, and of commercial value second to none in the United States." To be added is the number of eggs, 5,522,900, shipped to our Eel River station; making a grand total of 64,154,900 eggs for 1903. For the season of 1904, at this date, December 10th, we have at the Sisson hatchery 35,000,000 eggs; at the Eel River hatchery, 6,590,000; or in round numbers, 42,000,000. In addition to these eggs, we have already hatched and liberated the fry resulting from 10,000,000 eggs

taken from the summer run at Baird station on the McCloud River. The number of eggs on hand and now in various stages of development at Battle Creek and Mill Creek spawning stations will bring up the total to over 90,000,000, taken from the fall run of salmon; which, with the 10,000,000 from the summer run, makes a grand total of 100,000,000 salmon ova handled at our hatcheries in 1904.

Under date of November 22, 1904, Capt. G. H. Lambson, Superintendent of the United States Bureau of Fisheries stations in California, says: "The Sacramento River presents the best example of the good results of fish culture and protection of any stream in the country of which I have knowledge. The river is full each year to overflowing in spite of the great number of canneries, cold-storage plants, packers, and fresh-fish dealers, and they are increasing every year. I doubt if there were ever more fish running in the river than during the past few years, even in the old days when it was said a man could walk across the river upon their backs. It looks to me as if we will have no more seasons of bad runs, provided we can keep up our present output, as each year for the past three has been grand. Of course there will be seasons when we will not take so many eggs owing to high water, but the runs will be good."

Quoting from his letter of December 5, 1904, he states: "There is a large run of fish in both Battle and Mill creeks and there is hardly any limit to be placed upon the number of eggs we could take if we had the room. We could have taken fully eighty to one hundred million at Battle Creek and about sixty million at Mill Creek if we could have fished daily. We have worked but one fishing crew at each place, and then only about two thirds of the time."

CALIFORNIA FISH COMMISSION.

December 20, 1904.

SUPREME COURT DECISIONS.

S. F. No. 3679. In bank. August 7, 1903.

AH KING vs. SUPERIOR COURT.

Application for writ of prohibition against the Police Court of the City and County of San Francisco—E. P. Mogan, Judge.

For Applicant—Wm. Hoff Cook.

For Respondent—Lewis F. Byington, District Attorney.

By the Court: Petition for writ of prohibition.

The only question to be determined in this case is whether certain statutes relating to the preservation of fish and game are invalidated by the constitutional provision requiring acts of the Legislature to embrace but one subject. The contention of the petitioner is that fish and game are different subjects. The court is of the opinion that the preservation of fish and game is a single subject of legislation, and may properly be embraced in the same act.

Writ denied.

Crim. No. 1144. Department Two. June 20, 1904.

THE PEOPLE OF THE STATE OF CALIFORINA, Plaintiff and Respondent, *vs.* THOMAS J. MILES AND A. S. DINWIDDIE, Defendants and Appellants.

Appeal from the Superior Court of Sutter County—K. S. Mahon, Judge.

For Appellant—A. L. Shinn, T. H. Christianson, and A. H. Hewett.

For Respondent—U. S. Webb, Attorney-General; C. N. Post, Assistant Attorney-General.

Defendants were convicted on an information charging that on August 22, 1903, they were guilty "of the crime of setting and using a set-net in the waters of the State for the purpose of catching fish (a misdemeanor), committed as follows: That said (naming the defendants and the date) did then and there willfully, unlawfully and feloniously in the waters of the State of California, to wit, in the Sacramento Slough, in the said county of Sutter, * * * set and use a certain set-net, that is, a net which was then and there secured and was not free to

drift with the current and with the tide, for the purpose of catching fish, * * * contrary to the form," etc.

The trial court denied defendants' motion for a new trial and entered judgment on the verdict. Defendants appeal from the judgment and order.

* * * * * * * * * *

4. Defendants asked an instruction to the effect that there could be no conviction if the Sacramento Slough, mentioned in the information, at the time charged, had neither current nor tide. The court refused the instruction, and defendants now urge this as error. The information is laid under Section 636, Penal Code, which provides in part as follows: " * * * Every person who shall set, use, or continue, or shall assist in setting, using, or continuing any pound, weir, set-net, trap, or any other fixed or permanent contrivance for catching fish in the waters of this State—and every net shall be considered a set-net that is secured in any way and not free to drift with the current or tide—is guilty of a misdemeanor," etc. It is contended that the jury should have been told that unless there was a current or tide there could be no offense under this section. There was evidence that this slough empties into the Sacramento River about a half mile above the mouth of Feather River; is three or four miles in length, about one hundred feet wide at its mouth and twelve feet deep, and about eighty feet wide where defendants' net was set. Except in midsummer, this slough drains the back country lands into the river, but in August the water of the slough has no perceptible current. Fish may and do pass freely up and down the slough from the river. The ownership of the lands bordering on the slough does not appear. Defendants offered to prove the ownership, but the court held the evidence to be immaterial, and no objection was made or exception taken to the ruling. Upon the authority of *People* vs. *Truckee Lumber Co.*, 116 Cal. 397: "The dominion of the State for the purpose of protecting its sovereign rights in the fish within its waters, and their preservation, for the common enjoyment of its citizens, * * * extends to all waters within the State, public or private, wherein these animals are habited or accustomed to resort for spawning or other purposes, and through which they have freedom of passage to and from the public fishing-grounds of the State. To the extent that waters are the common passageway for fish, although flowing over lands entirely subject to private ownership, they are deemed for such purposes public waters, and subject to all laws of the State regulating the right of fishing." Citing cases. Whether or not the water of this slough, at the particular time defendants had their net set across it, was subject to movement by current or tide, is immaterial. They were forbidden by the law to use a set-net "in the waters of this State," *i. e.*, in any of the waters coming within the regulating

power of the State concerning the fish therein. The parenthetical words "free to drift with the current or tide" are but descriptive of the condition of a net; it must be free to drift and not be set or permanent.

It is advised that the judgment and order be affirmed.

CHIPMAN, C.

We concur:

COOPER, C.

GRAY, C.

For the reasons given in the foregoing opinion, the judgment and order are affirmed.

McFARLAND, J.
LORIGAN, J.
HENSHAW, J.

I desire to say further that while upon the record in this case it appears that appellant was not prejudiced by the guarded expressions of the court to the jury on the subject of their efforts to agree, still such expressions are hazardous, and it would be better for the court to say nothing on that subject. There might be cases where such remarks would be construed by the jury as urging an agreement to convict.

McFARLAND, J.

Crim. No. 972. Department One. May 20, 1903.

PEOPLE OF THE STATE OF CALIFORNIA, RESPONDENT, *vs.* PAUL HAAGEN, APPELLANT.

Appeal from the Superior Court of Santa Clara County—W. G. Lorigan, Judge.

For Appellant—John E. Richards.

For Respondent—U. S. Webb, Attorney-General; A. A. Moore, Deputy Attorney-General, and James H. Campbell, District Attorney.

This is an appeal by the defendant from a judgment of the Superior Court convicting him of the offense of violating Section 634 of the Penal Code, declaring it unlawful for any person, between the 10th of September and the 16th of October of each year, to have in his possession or sell any fresh salmon.

1. It is urged that the Superior Court has no jurisdiction of the offense. The punishment provided for the offense is a fine of not less than two hundred dollars or imprisonment in the county jail not less than one hundred and fifty days, or both. There is no maximum limit provided for either the fine or imprisonment. Section 19 of the Penal Code provides: "Except in cases where a different punishment is prescribed by the Code, every offense declared to be a misdemeanor is punishable by

imprisonment in the county jail not exceeding six months, or by a fine not exceeding five hundred dollars, or by both." It is claimed that this section must be read into Section 634 and that the two taken together provide a limit to the maximum fine or imprisonment prescribed for the offense here charged, thus fixing a punishment which lodges jurisdiction in the justice's court. This precise question with relation to Section 636, which was in all respects similar as to the punishment, except that the minimum fine was one hundred dollars, and the minimum imprisonment fifty days, was before the court in bank, in *People* vs. *Tom Nop*, 124 Cal. 150, and was there decided contrary to the appellant's contention. Upon the authority of that case we must hold the proposition to be without merit.

2. The defendant also claims that the information does not state a public offense. The charging part of the information is that the defendant "on the 11th day of September, 1901, at the County and State aforesaid, willfully and unlawfully *have* in his possession and *sell* a certain quantity of fresh salmon, contrary," etc. It will be observed that the verbs "have" and "sell" in the foregoing clause are not in the proper tense; that the word "did" is omitted, or that the words should be "had" and "sold" respectively. We do not think there is any merit in this contention. No information is insufficient by reason of any defect or imperfection in matter of form which does not tend to the prejudice of a substantial right of the defendant upon the merits. (Penal Code, Section 960.) Upon appeal this court must give judgment without regard to technical errors or defects "which do not affect the substantial rights of the parties." (Penal Code, Section 1258.) No error or mistake in any pleading renders it invalid unless it has "actually prejudiced the defendant, or tended to his prejudice in respect to a substantial right." (Penal Code, Section 1404.) We can not see from the record that there was any difficulty on the part of any party concerned in the trial in ascertaining from the information precisely the nature and character of the offense charged, nor can we perceive how the defendant could have been prejudiced by the defect in the information in respect to any substantial right, or any right.

3. The further contention was made that the court erred in refusing to allow the defendant to offer evidence to show that the fish in question was caught prior to the 11th day of September, 1901. It will be noted that the charge, in effect, was that he had in his possession and sold the fish in question on the 11th day of September, which was the first day of the season provided by the statute. The claim of the defendant is that, if the fish were caught prior to the close season, they became articles of merchandise and the property of the person taking them, and hence, that the Legislature did not have the power to prohibit the sale of such merchandise, and could not restrict the right to

possess the same. It is also claimed that such a statute, if applied to fish caught or bought before the close season begins, is unjust and unreasonable. These questions were all thoroughly considered in *Ex Parte Maier*, 103 Cal. 476. In that case it was claimed that the fact that the game in question had been purchased in the State of Texas and brought into this State made it an article of merchandise, the possession of which the Legislature could not forbid. The court, however, held the contrary, and that case must be taken as decisive of the question.

We find no error in the record; and it is, therefore, ordered that the judgment be affirmed.

SHAW, J.

We concur:

ANGELLOTTI, J.

VAN DYKE, J.

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